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ON THE HOMOLOGIES AND MECHANISM OF THE MOUTH-PARTS OF HEMIPTERA.

By F. Muir and J. C. Kershaw,

Mossman, North Queensland.

PART I. The Homologies of the Mouth-parts.

The morphology of the head of Hemiptera has received several interpretations, some writers maintaining that there are no traces of mandibular structure, while others consider the outer pair of setæ as the mandibles, and the inner pair as the maxillæ, but most writers agree in considering that the setæ are sunk into the head-capsule. One of the authors in a former paper[1] endeavored to show that in *Pyrops candelaria* the mandibles were present and articulated in their normal position, viz., to the head-capsule, between the clypeus and the maxillæ, and that the maxillæ are present in the form of two large plates in intimate contact with the maxillary setæ. In the present paper the authors have endeavored to show that the same interpretation holds good for other Hemiptera, and also that the frons, clypeus and labrum of many systematists are, in many families, respectively the clypeus, labrum and epipharynx.

If the head of a Cicada (Fig. 1) be softened in water or caustic potash the groove (*ms*) along each side of the anterior part of the head will prove to be a distinct suture, whose edges are pressed closely together, but neither cemented nor joined by membrane. We will call this the "*mandibular suture.*" At the posterior end of this suture are articulated, by a true ginglymus articulation, the mandibular setæ (*art. man. s.*). The dorsal surface between these two points will be the clypeus or clypeal region (*cl r.*). The position of the articulation of this seta enables us to homologize it

[1] A Memoir on the Anatomy and Life-History of the Homopterous Insect *Pyrops candelaria*. J. C. Kershaw. Zoöl. Jahrb. Abth. f. Anat.: XXIX, p. 105–124.

with the mandible of mandibulate insects. The lateral edges of the clypeus are often turned down and produced into free plates (*c*) projecting forward and fitting in between the labrum and the maxillary plates (*mx p*). The separation of the clypeus and the labrum is often difficult to recognize in an external view, but internally the anterior part of the pharynx is fastened to the anterior part of the clypeal region by two chitinous struts or pillars; beyond this point the walls of the pharynx separate into the epipharynx and hypopharynx; the pharyngeal muscles are attached to the wall of the clypeus. The division between the labrum and the epipharynx is often very obscure, and it may be more convenient to use the compound word "labrum-epipharynx," as is done in the Diptera. The latero-ventral coverings of the mouth are formed by two plates (*mx p*), the anterior edges meeting along the ventro-medial line, thus closing the mouth below and beyond the hypopharynx and syringe. The maxillary setæ pass through the membrane (hypodermis) at the base of the inner side, and the protractor muscles run forward and attach themselves to the walls, of these plates. We homologize these plates as the maxillæ of mandibulate insects, and the setæ as maxillary setæ. Judging by Prof. Smith's study of the development of the palpifers in many insects, it is probable that the maxillary setæ in this order and in Thysanoptera are also developments of the palpifers. In the Homoptera the gular region is reduced to a minimum, in many cases being but a thin membrane connecting the labium with the occipital region; this causes the deflection of the head. The occipital foramen is very large. Posterior to the antennæ the head-capsule is often developed into a "frontal" or antennal ridge (*fr*); this plays but a small part in the Homoptera, but in the Heteroptera it is large, and greatly modifies the shape of the head.

In many of the Hemiptera (i. e., *Siphanta*, Fig. 5) the mandibular setæ (*man. s.*) are broad and bent a little beyond the base, protractor and retractor muscles proceeding to the head-capsule. In such forms their homology to mandibles is clear, but in other Hemiptera, especially among the Heteroptera, the tendon of the retractor muscle is greatly developed, and appears as the basal part of the setæ proceeding to the back of the head, the bent true basal portion being greatly reduced and specialized; in such

forms it is hard to homologize them with mandibles without some knowledge of the more generalized forms.

The Cercopid head (Fig. 2) is similar to the Cicada. The clypeus (*clr*) is large; the mandibular sutures (*ms*) run half way along its sides; the frontal ridges (*fr*) are drawn out over the antennæ, and along the basal sides of the clypeus, and the gula is greatly reduced. The mouth parts of the Tetigonids are easily homologized with these.

In the Membracids (Fig. 3) all the same parts can be plainly seen. The clypeus (*clr*) is reduced somewhat basally; the mandibular sutures (*ms*) approach nearer to the antennæ; the frontal ridges (*fr*) are well developed, and the gula is greatly reduced.

Among the Derbids (Fig. 4) and Siphantas (Fig. 5) the head is drawn out anteriorly; the clypeus (*cl r*) has its lateral parts (*c*) long and the mandibular sutures (*ms*) running back to near the base of the clypeus. In some species the eyes are comparatively small and the genæ large (Fig. 5, *ge*), in others the eyes are large and the genæ much reduced (Fig. 4, *ge*). The frontal ridges are very little developed in these families.

It is easy to homologize the head parts of most other families of Homoptera with the families quoted above, but the Heteroptera are more difficult. This is greatly on account of the gular region being much more largely developed, thus preventing the deflection of the head and throwing the whole of the ventral and lateral parts of the head forward. The frontal ridges are greatly developed, and alter the shape of the head, but this is also the case among the Psyllids.

Among the Lygæids (Fig. 6) the homologies of the head are clear. The clypeus (*cl r*) with its lateral pieces (*c*) are well developed; the mandibular sutures (*ms*) run to near the antennæ; the maxillary plates (*mxp*), owing to the development of the gula and the anterior position of the labium, are greatly shortened. The frontal ridges are absent, unless the raised rim around the antennæ represents them.

Among the Pentatomids the frontal ridges play a conspicuous part. In Cyrtocoris they are large, project forward, and divaricate like horns. In Tessaratoma (Fig. 7) they are flattish, project forward, and meet along the central line (*c. fr*), the clypeus being deflexed near its base, and passes between them (*c. clr*) The

head-capsule behind the eyes is well developed, the gula large, the maxillary plates (*a & b mxp*) reduced and the mandibular sutures (*a. ms*) short and end near the antennæ.

In the Coreids (Fig. 8) we find a similar arrangement, but the inner edges of the frontal ridges do not meet together so closely and do not cover the base of the antennæ. The gular region is elongated.

In certain of the Pentatomids (Fig. 9) the clypeus (*cl r*) is deflexed near its junction with the labrum, the frontal ridges (*fr*) lie alongside of, but do not fuse with it. The clypeus thus becomes dorsal, and the maxillary plates are thrown forward. A similar arrangement takes place in the genus Coleotichus.

The Reduviid head (Fig. 10) is the most difficult of all the Hemiptera to homologize, on account of the distortion that has taken place through its elongation, the ventral part having developed out of all proportion to the dorsal surface.

In Pristhesancus (Fig. 10) it is impossible to recognize the clypeal region from an external view, but upon dissection one finds that the pharynx is attached to the head by its lateral struts at a point slightly anterior to the base of the antennæ (*b. st*), and the pharyngeal muscles are attached to the medio-dorsal surface behind these points. By homology with other Hemipterous heads this must be the clypeal region (*c. clr.*). This form of head could be brought about by two processes, firstly by amalgamation of the sides of the frontal ridges with the sides of the clypeus in such a head as Figure 9, and the forward movement of the lateral parts of the head, along with the elongation of the gula; or, secondly, the frontal ridges could have moved forward with the lateral and ventral parts of the head, and become abortive, leaving the clypeus surrounded by and fused with the head-capsule. In allied species there is a small prominence behind each antenna which appears to be the remains of the frontal ridges, thus indicating that the latter process is the more likely one. The labrum and epipharynx (*lb e*), the maxillary plates (*mxp*) and the mandibular sutures (*ms*) and the articulation of the mandibular setæ (*art. man. s.*) are normal and easily homologized with other Hemipterous heads. The head behind the eyes is greatly elongated.

The nearest homology to the Hemipterous mouth parts is

found in the Thysanoptera, where the maxillæ form long, sub-triangular plates which, together with the labrum, form a short tube through which the setæ pass. The paired setæ are mandibular, and the unpaired seta pertains to the left maxillary, the right being absent.[2] An analogy, if not homology, is to be found among the Myriapods in the family Polyzoniidæ[3], where the mouth is adapted for sucking. Here the upper lip is produced into a narrow snout, the lateral edges being turned down to form a semi-tube; the protomalæ are drawn out anteriorly into long slender setæ, with slightly spoon-shaped tips, set round its edges with fine teeth, the basal part being stouter, somewhat triangular, and articulated in the normal position (viz., near the base of the dentomalæ). The dentomalæ form a thin plate, rounded at its base, and drawn out thin anteriorly, which fits exactly against the edges of the elongated upper lip, entirely covering the protomalæ, thus making them internal organs.

PART II. The Mechanism of the Mouth-parts.

The membranous œsophagus (Figs. 11 & 12 *oe*) passes between the brain (*br*) and the sub-œsophagal ganglion (*sg*), and then merges in the chitinous pharynx (*ph*). The pharynx is of the usual double U-shape in transverse section, the dorsal plate being thin and flexible, and capable of retraction from the thick and chitinous ventral plate by the powerful pharyngeal muscles (*phm*), thus creating a vacuum into which the liquid food flows; the dorsal plate then falls back against the ventral plate by the natural elasticity of the pharynx. The whole structure constitutes the pharyngeal pump. The anterior portion of the dorsal plate (*dph*) of the pharynx continues along the under side of the labrum (*le*) and forms the epipharynx (*e*). The ventral plate of the pharynx (*vph*) continues forward and forms the spoon-shaped and acute hypopharynx (*hyp*). At the anterior end of the pharynx the lateral edges of the ventral plate emit two struts (*st*), one each side, which diverge laterally and upwards, and fuse with the anterior sides of the clypeal region (*clr*). These struts form the

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[2]See Note A.

[3]The description of this mouth is taken from a species very common in rotten wood in the Island of Ceram.

main support of the pharynx. Just below these pharyngeal struts the pharynx emits two other struts (ts^1), one each side, which proceed almost horizontally and posteriorly and fork, sending a strut (ts^2) anteriorly to the base of the salivary-pump or syringe (*sp*). This strut again forks and sends a strut (ts^3) anteriorly to the base of the labium (*bl*). Posteriorly (beyond the first forking) the struts become broad and thin plates following the sides of the pharynx, and attached to its outer walls by tissue. The plates in transverse section are roughly V-shaped (Fig. 12*d*) and connected together by tissue; they enclose and protect the setæ. From the posterior end of the chitinous pharynx, where the plates become broadest, they rapidly narrow to mere tendons, which extend right to the occipital foramen, where the tips of the two tendons broaden slightly, and attach to the occiput near the attachment of the retractor muscles of the setæ. In more generalized forms, such as the Cicada, the posterior ends of these seta-guides are connected by a transverse piece which gives off two branches that are attached to the dorso-posterior part of the head-capsule. This appears to indicate that the whole structure is a modification of the tentorium to form a guide or protection to the setæ, and give support to the floor of the mouth for the working of the salivary syringe. We therefore call this arrangement of struts, plates and tendons the tentorial structure (*ts*).

The syringe, or salivary pump (*sp*), lies beneath the anterior part of the pharynx and opens on the basal part of the labium (*bl*), beneath the hypopharynx. The body of the syringe is cup-shaped, and highly chitinous, with an inverted top, thinner and more flexible, which forms a plunger. From the center of the plunger rises a chitinous tendon or plunger-rod, around which are attached the powerful retractor muscles (*spm*). These muscles divide slightly posteriorly and form two branches which attach to the base of the occiput beneath the occipital foramen. The two salivary ducts (*sd*), after entering the head, lie on the floor of the head-capsule in the space between the two branches of the syringe muscles, and join in a very short common duct just before entering the syringe near the valve (*v*). This valve is formed by a membraneous fold of the syringe wall, which covers a shallow recess made by a bulge in the wall where the common duct enters.

The orifice of the syringe tube opens through the base of the labium, and is covered by a small chitinous tongue (*pt*), which lies just beneath the hypopharynx. The plunger being retracted by the muscles (*spm*) draws the saliva from the ducts (*sd*) into the syringe barrel. On the relaxation of the muscles, the natural elasticity of the plunger performs the return stroke, closing the valve (*v*) and forcing the saliva past the tongue (*pt*) on the base of the labium.

The labium is four-jointed and sub-cylindrical in cross-section, with a longitudinal groove running down its dorsal surface. Beyond the distal end of the labrum-epipharynx (*le*) the edges of the groove meet together, and so form a trough in which the setæ lie. Strong muscles between the dorsal and ventral walls of the labium enable the edges of the trough to be parted so as to set the setæ free. The ventral wall (Fig. 13, *vwl*) is formed by very thick chitin, perforated by numerous pores; the dorsal wall (*dwl*) is thin and flexible. Two large tracheæ (*tr*), and two nerve-cords (*n*) pass down to the tip of the rostrum. The rostrum is retracted and drawn up to the underside of the head—into its normal position at rest—by the retractor muscles (Fig. 11, *rm*) attached to the greatly reduced first ventral sclerite (*vbl*[4]); it is extended by the muscles (*em*) attached to the second dorsal sclerite. Longitudinal muscles down the interior of the rostrum actuate the several joints thereof; the last joint, or tip, is especially mobile, and can be deflected laterally to either side.

Almost on the mandibular suture (Fig. 10, *ms*), but slightly below and at the posterior end thereof, the mandibles are connected to the genæ by a ginglymus articulation (Fig. 12, *g* and Fig. 10, *art. man. s*), consisting of a small rod and triangular plate, the latter hinging directly to the gena. The protractor muscles (*pm*[1]) of the mandibles (*man. s*[1]., Figs. 12 and 14) attach to the clypeal region between the bases of the antennæ, and at the other end at one arm of the triangular base of the mandible (Fig. 14, *tbm*). A membranous sleeve (*msl*), arising from near the articulation of the triangular base of the mandible, encloses the mandibular seta, and forms the air-tight joint; at the anterior end the sleeve (part of hypodermis) opens near the base of the maxillary plate. Behind the ginglymus the setæ narrow to mere

[4]This is the free part of basal labial joint; the rest is fused with gular region.

tendons, at the posterior ends of which are the retractor muscles (shown broken off in Fig. 12*b*), attaching to the occiput on each side of the occipital foramen.

The muscles of the maxillary setæ are much more powerful than the mandibular muscles. The protractor muscles (Fig. 12*b*, *pmx*^{2}) attach to the maxillary plate (Fig. 10, *mxp*). In the drawing they are shown slightly curved, to avoid confusion with other parts, but in reality they are practically straight. The retractor muscles attach to the occiput on each side of the occipital foramen. Passing forward between the plates of the tentorial structure (*ts*), (where the mandibular setæ lie on a slightly higher plane than the maxillary) the pairs of setæ on either side of the pharynx approach closer together and pass between the struts (Fig. 11, *ts*^{1} and *ts*^{2}) from the pharynx and the base of the labium, run alongside and partly beneath the hypopharynx, and descend over the base of the labium (*bl*) into the rostrum. Soon after entering the rostrum, the maxillary setæ close together and interlock (Fig. 13 *max s*), forming an air-tight tube. The tips of the maxillary setæ are acute and smooth. The tips of the mandibular setæ are flattened and acute, and numerously and minutely barbed on the outer sides, the barbs pointing backwards. The tips of both pairs of setæ are practically without curve. The mandibular setæ are quite free from the maxillar setæ, though they lie close on each side of the former in the rostrum.

That the maxillary setæ form an air-tight tube can easily be seen under a fairly high power, when liquid food and bubbles of air can be traversed from end to end of the tube by pressing with a needle. The maxillary setæ or sucking-tube can be protruded far beyond the tip of the rostrum, whilst the mandibular setæ can be protruded only slightly. The latter are used to pierce the prey, and retain it in position by means of their barbed tips, whilst the maxillary setæ forming the sucking-tube are probed and extended into every part of the body where there are any juices. It seems probable, also, that the sucking-tube is used to conduct the poisonous saliva from the syringe into the wound madein the animal attacked. On attacking any animal the bug probably slightly protrudes the tips of the setæ and contracts the muscles at the end of the rostrum, the latter thus closing on and holding the tips of the setæ firmly. The animal is then pierced and securely

held by the barbed tips of the mandibular setæ. It seems highly improbable that long slender rods like the setæ could pierce a chitinous insect without some support near their tips. Carnivorous bugs almost invariably suck their prey whilst it is suspended from the tip of the rostrum, the bug meanwhile resting head downwards; they often retain their hold on the prey and continue to suck out its contents whilst the labium is withdrawn against the ventral plates of the head and thorax—its usual position when at rest. This feat would be impossible unless the prey was held by the barbed tips of the mandibular setæ, whilst the maxillary setæ were used to search the interior of the body for juices.

Note A. (Fig. 14)

This interpretation differs both from Uzel's and Garman's, and is founded upon observations of a head of one of the *Tubulifera* common in the flower of the sugar cane in the Mossman district (North Queensland). We figure this head and give the following short description to prove our homology.

The head-capsule is of the usual Thrips type, being deflexed and inflexed, the mouth-parts being brought between the front legs, as in Homoptera. The anterior edge of the head-capsule (the oral margin) is strengthened by a thick rim of chitin (*r*). From this rim arise two short pillars (*k*), one on each side, above the maxilla, which proceed backward into, and sub-parallel with the wall of, the head-capsule. At the distal end of these pillars are articulated, by a perfect ball and socket joint (Fig. 14, *z*), the mandibular setæ. Beyond these pillars are two stout conical pegs arising from the head-capsule, evidently for the attachment of muscles. The clypeus (*clr*) is well developed and slightly asymmetrical, the left basal corner being emarginate. The labrum (*lb*) is small, with its lateral edges bent round ventrally to form a semi-tube. The right maxilla is formed by a sub-triangular plate (Fig. 14*a*. *mxp*), the palpus arising from a membranous part of the center; the left maxilla is asymmetrical, a membrane separating the sub-triangular distal part, bearing the palp (Fig. 14 *y*. *mxp*. *b*.), from the rounded basal part bearing the seta (Fig. 14 *y*, *mxp*. *a*. and *max*. *s*.). This basal part is capable of movement apart from the distal part, and carries the seta along with it. The anterior edges of the maxillæ meet in the medial line beneath

the labrum and help to form the tube beyond the pharynx through which the setæ pass. The labium is short, wide, and consists of three parts, a broad basal portion (mentum?), a second smaller part bearing the palpi (palpifer?), and a minute distal portion bearing two minute bodies (paraglossæ?). The pharynx is small, well developed, and situated below the clypeus, to which it is attached by lateral arms; the epipharynx and hypopharynx are indistinguishable. The base of the maxillary seta is short, the tip flat and acute, without barbs, and evidently only used for piercing. The mandibular setæ are slightly spatulate at the tips, and show no traces of groove under a 1-9 inch objective.

The paired setæ we consider as mandibular, homologus to those of Rhyncota, the part of the rim of the head-capsule to which they were articulated having grown inwards to form the mandibular pillars (*k*). The unpaired seta arises from the left maxilla, and is part therof. The sub-triangular plates forming the maxillæ may be the palpifers, the other parts being reduced or lost. This interpretation was confirmed on another species of Tubulifera, but two species of Terebrantia differed, and showed an arrangement of mouth organs agreeing with Garman, viz:— one mandibular seta on the left, and a pair of maxillary setæ. It is possible that this difference of mouth-parts will run through these two sub-orders.

Uzel's figure of *Æolothrips fasciata* does not bear out his suggestion that the unpaired seta is a development of the epipharynx, and in the species herein figured, there is no doubt of its maxillary origin.

June, 1910.

EXPLANATION OF PLATES.

Fig. 1. Head of a Cicada
Fig. 2. Head of a Cercopid
Fig. 3. Head of a Membracid
Fig. 4. Head of a Derbid
Fig. 5. Head of a Pockillopterid
Fig. 6. Head of a Lygaeid.
Fig. 7. Head of a Pentatomid
Fig. 8. Head of a Coreid
Fig. 9. Head of a Pentatomid

Fig. 10

Head of a Reduviid

In these ten figures a = front view, b = side view, c = dorsal view.

Fig. 11

a = Longitudinal median vertical section of anterior part of head.
b = View looking down on pharynx, etc.
c = View looking on side of pharynx, etc.
In b and c, some of the parts are drawn slightly out of their natural position, to avoid hiding some of the structure.

Fig. 12

a = Longitudinal median vertical section of head.
b = Longitudinal horizontal section of head (slightly diagrammatic).
c = Transverse section of head in front of antennæ, looking towards the occipital foramen.
d = Transverse section cut rather more posteriorly than c.

Fig. 13

Transverse section of rostrum.

Fig. 14

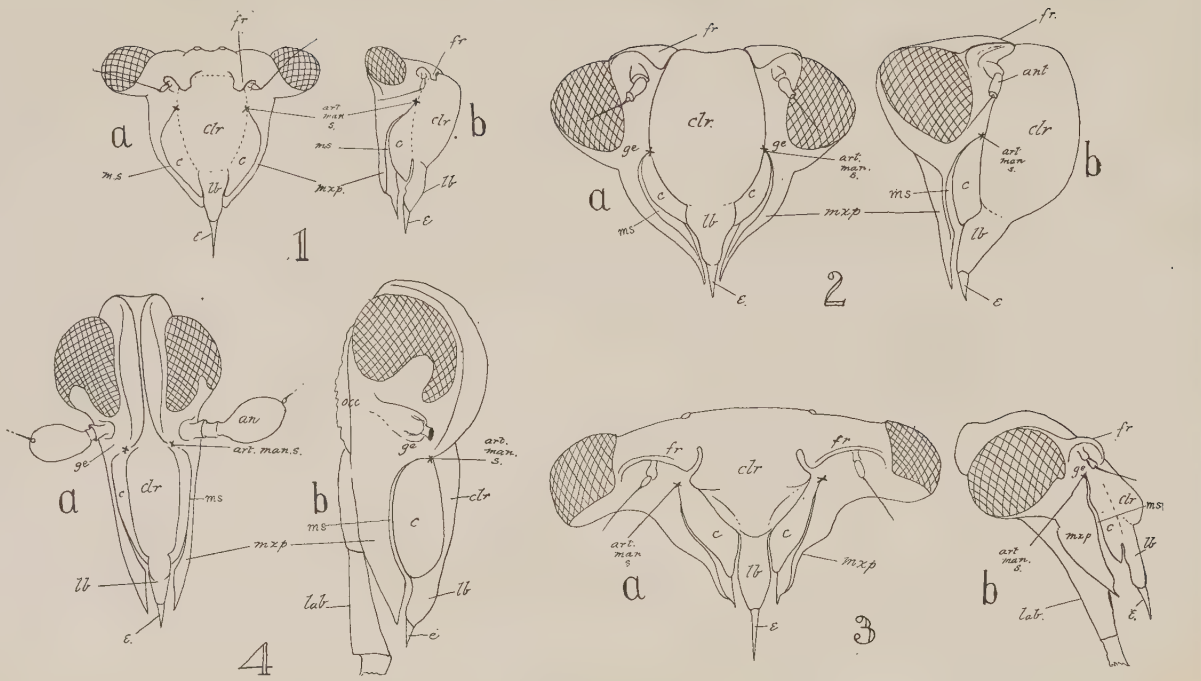
Part of R. H. mandibular seta, much enlarged.

Fig. 15

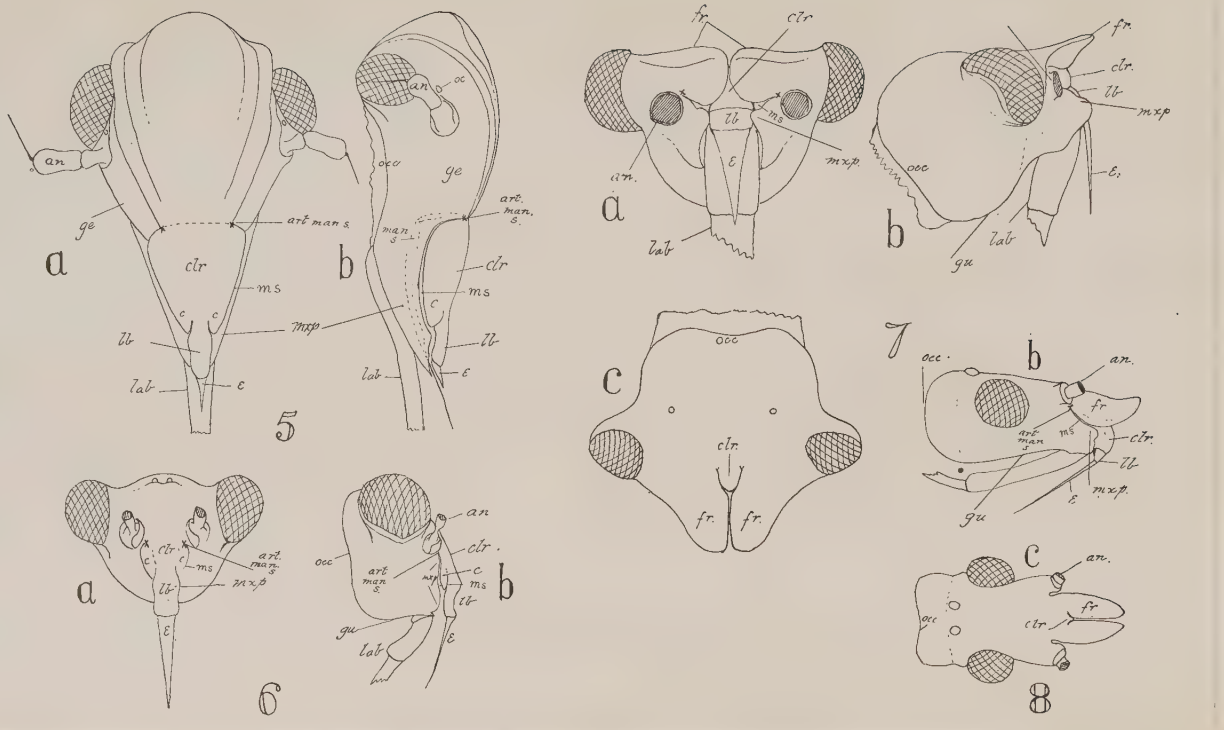
Head of a Thrips
a = front view.
b = side view
y = left maxilla enlarged
z = articulation of seta with mandibular pillar

Lettering of Figures.

am = antennal muscle
an = antenna
art. man. s. = articulation of mandibular setæ
bl = dorsal base of labium
br = brain
c = clypeus, lateral edges of (loræ)
clr = clypeal region
dph = dorsal plate of pharynx
dwl = dorsal wall of labium
e = epipharynx
é = eye
em = elevator muscle of labium
fr = frontal ridge
g = ginglymus articulation of mandibular setæ
ge = genæ
gu = gular region
hc = head capsule
hyp = hypopharynx
k = mandibular pillar
lab = labium
lb = labrum
le = labrum-epipharynx
m = muscles
man. s. = mandibular setæ
max. s. = maxillary setæ
ms = maxillary suture
msl = membraneous sleeve
mxp = maxillary plate
n = nerve
oc = ocellus
occ = occiput
oe = œsophagus
ph = pharynx
phm = pharyngeal muscles
pm^1 = protractor muscle of mandibular setæ
pm^2 = protractor muscle of maxillary setæ
pt = syringe-tongue
pth = prothorax
r = thickened rim of head-capsule
rm = retractor muscle of labium
s = setæ
sd = salivary ducts
sg = sub-œsophageal ganglion
sp = salivary syringe
spm = salivary syringe muscles
st = pharyngeal strut
t = tendon
tbm = triangular base of mandible
ts = tentorial structure
tr = trachea
v = valve of syringe
vbl = ventral base of labium
vph = ventral plate of pharynx
vwl = ventral wall of labium



MUIR AND KERSHAW—MOUTH-PARTS OF HEMIPTERA.



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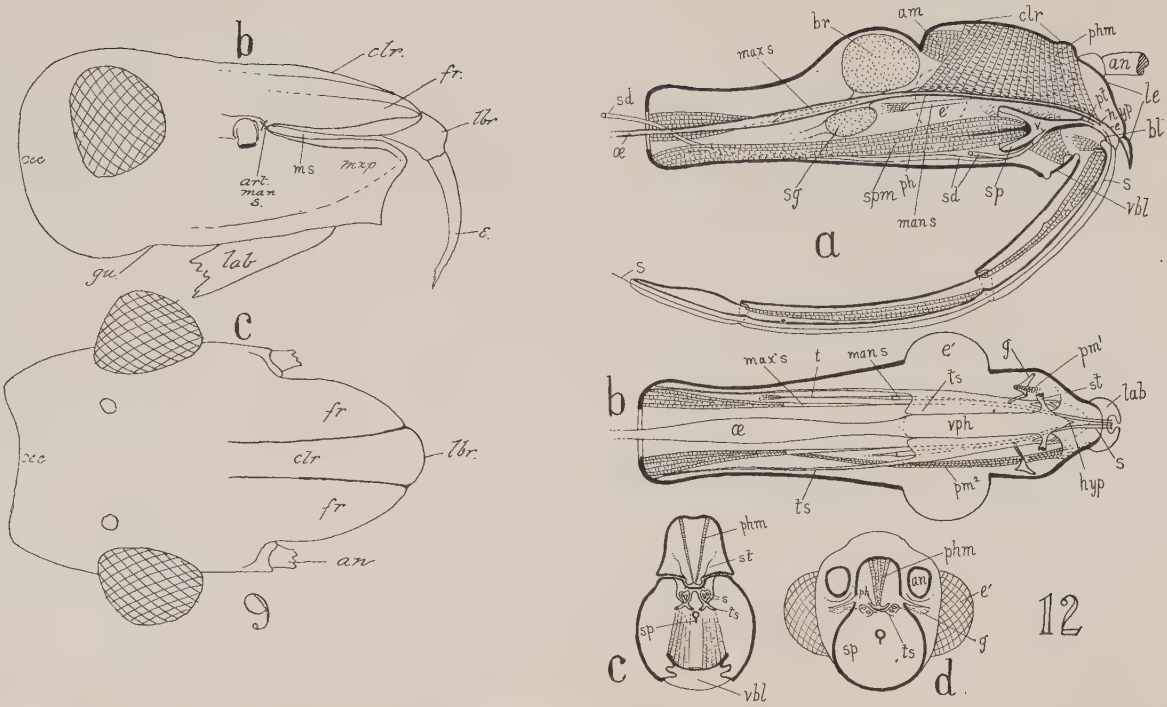

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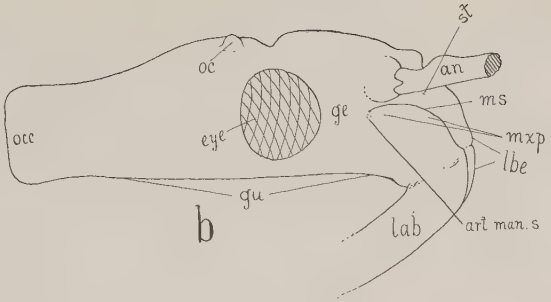
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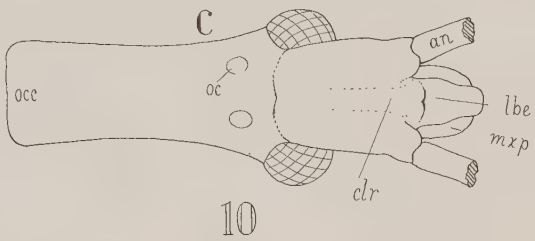
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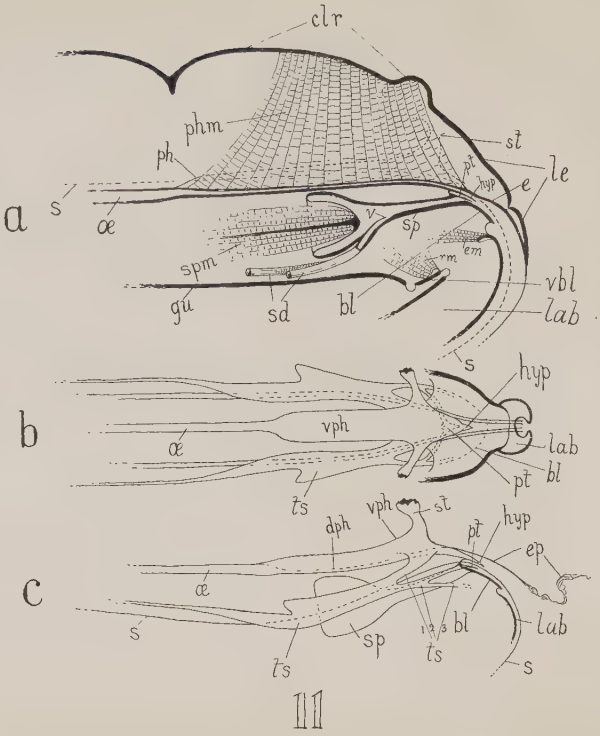
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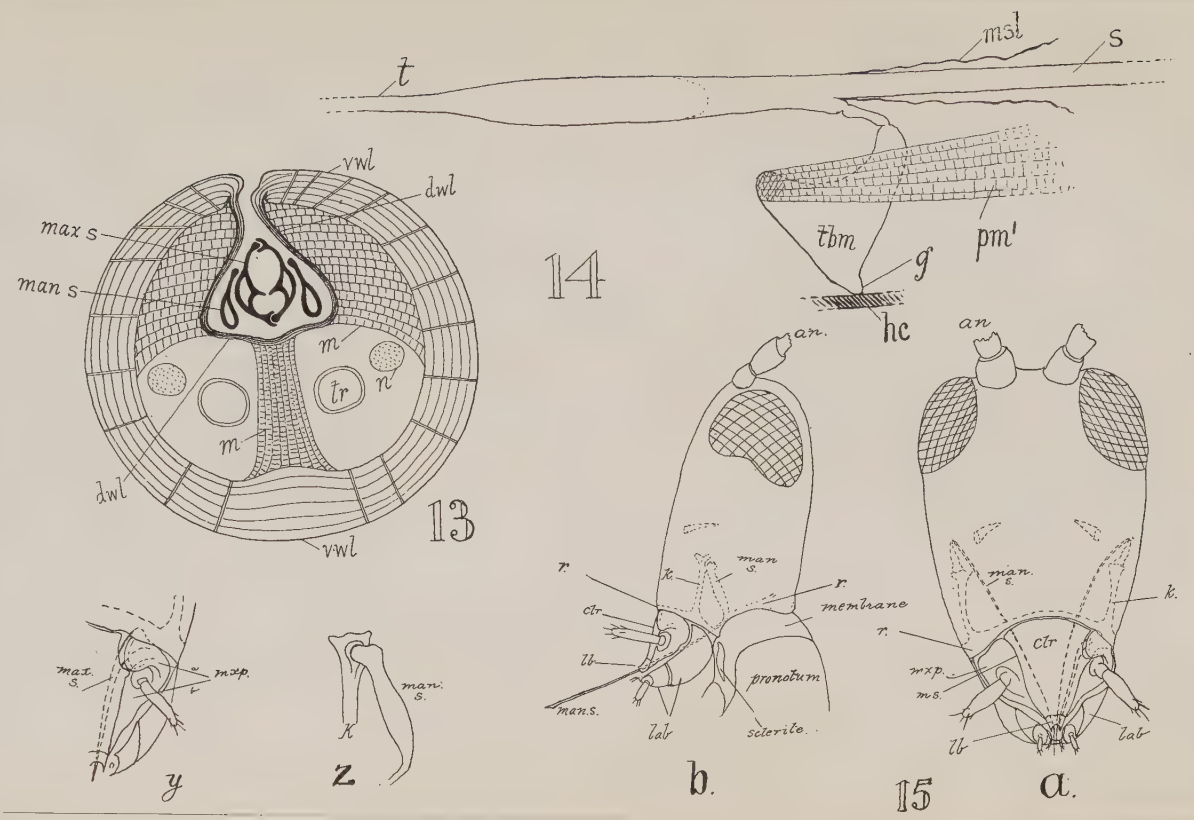

MUIR AND KERSHAW—MOUTH-PARTS OF HEMIPTERA.

A NOTE ON THE HUNTING HABITS OF AN AMERICAN AMMOPHILA.

By C. H. Turner.

Sumner High School, St. Louis, Mo.

Fabre found that the Ammophilas studied by him stored their nests with caterpillars which they dug out of the ground. The published results of American students of these wasps seem to indicate that our native Ammophilas have a different habit. Carl Hartman[1] found that the large *Ammophila procera* stores its nest with the tomato caterpillar, and the Peckhams[2] say that *Ammophila urnaria* never digs for her prey. A chance observation, made this fall, shows that some American Ammophilas dig in the ground for caterpillars with which to stock their nests. It was about eleven o'clock on the morning of September 17th, 1910. The day was warm and the sun was shining brightly. In sauntering along a narrow foot-path on the top of a hill at Edgemont, Ill., I noticed an *Ammophila* sp. digging in the barren pathway.

Thinking that she was digging a nest, I dropped upon the ground to observe her method of work. After biting out a bit of earth with her mandibles, she would retreat a distance of about three times her length, then flirt broadcast, the dirt and return for another load. Her movements were so quick and jerky that one is tempted to call them nervous. Twice she left the spot and flew away, only to return and continue the excavation. After she had dug just deep enough for her prothorax to be hidden from view, she suddenly disappeared into the ground. This was my first intimation that the wasp was not digging an original burrow. Even then I did not grasp the full significance of her behavior, for I immediately concluded that she had uncovered a burrow which had been made by her earlier in the morning.

[1]Observations on the Solitary Wasp of Texas, 1905, p. 13.
[2]The Solitary Wasp, 1898, p. 9.

After the lapse of a few minutes, the wasp slowly emerged from the burrow until her two posterior pairs of legs and all of her body, except the prothrorax and head, were outside of the hole. Bracing herself with her legs and straining every muscle of her body, the Ammophila spent fully five minutes tugging and pulling at something in the burrow. And at what? Presently a portion of a caterpillar became visible in the mouth of the burrow. A few more minutes of tugging and pulling and a large caterpillar was dragged to the surface and to a short distance from the burrow. The Ammophila had been digging for prey!

After dragging the caterpillar a short distance from the hole, the Ammophila held it, with her mandibles, by the back of the neck and, curving her abdomen around to the ventral side of the caterpillar, stung it several times. Although the stinging was done deliberately, yet it was done so quickly that, from my position, it was impossible to determine into which somites the sting was thrust. Having completed the stinging, the Ammophila proceeded to malaxate the neck. Fully five minutes were occupied in this procedure. All of this time the caterpillar had been resting with its ventral side towards the ground. The Ammophila now rolled the caterpillar over upon its back, straddled it, and, grasping it by the throat with her mandibles, walked rapidly away, trailing the limp insect beneath her body. At about two yards from the spot where the caterpillar was captured, the wasp placed it on a lower twig of a bush, made an orienting flight and flew away.

A pressing engagement forced me to leave at this stage and prevented me from seeing what disposition the wasp made of the caterpillar; but, although I did not see this wasp place that caterpillar in a burrow, yet I did see a wasp of the same species carry a caterpillar of the same kind into a burrow; and a friend of mine, who was waiting for me in a different portion of the field, saw an Ammophila of the same species place a similar caterpillar in a burrow and seal it. Evidently some of our American Ammophilas resemble those studied by Fabre in storing their nests with subterranean caterpillars.

NEW NEOTROPICAL PLŒARIINÆ.

By E. Bergroth,

Fitchburg, Mass.

Myiagreutes gen. nov.

Head elongate, as long as anterior lobe of pronotum, with a deep straight furrow between the eyes, anteocular part seen from above parallel from the eyes to the base of the antennæ, then conically produced and sloping obliquely downward, postocular part shorter than the anteocular, somewhat tumid anteriorly, tapering toward the base, its lateral margins slightly sinuate before the middle, eyes large, globular, strongly prominent, throat longitudinally moderately convex, antennæ inserted about midway between eyes and apex of head, capillary, longer than the body, glabrous (at least in the female) rostrum obtusangularly geniculate between first and second joint, first joint reaching base of antennæ, second joint a little shorter than first, reaching anterior margin of eyes, third joint almost as long as the two basal joints together and much more slender. Pronotum in the middle strongly constricted and transversely impressed, anterior lobe arched, tapering backward, with a narrow median furrow throughout its length, the sides very slightly rounded, the apical angles with a tubercle armed with a straight spine directed outward and a little forward, posterior lobe campanulate, covering the mesothorax, moderately declivous, the disk broadly and slightly excavated anteriorly in the middle, armed behind with three spines, one erect in the middle a little before the basal margin and one obliquely ascending above the humeral angles, basal margin truncate. Scutellum twice as broad as long, unarmed but elevated in the middle, angularly gibbous in profile, apical margin slightly rounded, almost as long as the basal margin; postscutellum elongate-triangular, two times longer than scutellum, with a small tubercle before the apex and a short suberect spine at the apex. Prosternum with a longitudinal furrow on each side, the intercoxal process bearing the stridulatory furrow strongly rectangularly elevated. Meso-and metasternum longitudinally carinated in the middle. Hemelytra a little narrower than the abdomen (♀), corium with the outer apical part narrowly prolonged far beyond the middle of the membrane, inner vein furcate in the middle, forming a long triangular cell, clavus very narrow, membrane rather narrowly rounded at apex, the inner basal cell triangular, very much shorter and narrower than the outer basal cell, this subparallel in the middle and triangularly tapering toward the apex which emits a single simple vein, outer apical cell with a fine simple vein, inner apical cell with a free thick vein emitting branches toward the inner margin. Abdomen (♀) gradually widening from its base to the apex of the fourth segment, then parallel to the apex of the fifth from where

it is strongly tapering to the tip, apical margin of last dorsal segment obtusangularly rounded, the ventral sutures almost straight, the spiracles situated before the middle of the segments, the female dorsal genital segment sloping. Fore coxæ half as long again as the head, slightly tapering toward the apex, trochanters unarmed, femora a little longer than the head and pronotum together, except near base and apex armed beneath with two rows of mingled spinules and bristles, the outer row with some larger spines intermixed, the inner row rather broadly interrupted in the basal half, tibiæ and tarsi together considerably shorter than the femora, the tibiæ curved, reaching beyond the middle of the femora, finely crenulate beneath and with a rather long densely setose depression above in the apical half, tarsi flexible, four times shorter than the tibiæ, three jointed, the suture between the two first joints very oblique, first joint a little shorter than the two other together, third joint longer than second with two closely approximate obtusely dentate claws of subequal length. Middle femora slightly overreaching the apex of the abdomen, shorter than the tibiæ. Hind femora reaching far beyond the apex of the abdomen, tibiæ much longer than the femora and than the body.

Belongs to the Division Stenolæmaria. Among the American genera this remarkable genus comes nearest to *Westermannias* Kirk. and *Lutevopsis* Champ., but it is more allied to the Old World genus *Myiophanes* Reut.

Myiagreutes praecellens sp. nov.

Above dull, beneath slightly shining; black, with the following ochraceous markings: a round spot on either side just before and behind the transverse furrow of the head, the base of the head, the apical and basal margin of the pronotum including all the spines, two oblique streaks, one behind the other, on either side of the basal part of the pronotal fore lobe, a round anterolateral spot on either side, two apical anteriorly fused longitudinal median bands and two narrower more distant longitudinal basal bands of the pronotal hind lobe, the posterior margin of the propleura (interrupted near the middle) and of the mesopleura, the acetabula, the elevated median part and the apical margin of the scutellum, the apical spine of the postscutellum, the base of the corium interiorly prolonged backward a little beyond the postscutellum, the broad margins of the interior branch of the inner corial and of the apical corial vein (including these veins themselves), a fascia running from the inner part of the apical margin of the corium obliquely forward to the costal margin, the basal half and the apex of the clavus, a posterior U- shaped figure in the exterior basal cell of the membrane anteriorly fused with more obscure indefinite spots of the same color, the inner apical cell (except the free ramose central vein) and two longitudinal bands in the outer apical cell with its central vein, a subquadrate basal spot to the connexival segments above and beneath, the spiracles, two rather broadly separated basal quadrangular spots to the ventral segments, a narrow sublateral band, interrupted at the basal

margin of the segments, in the apical half of the venter, and the female dorsal genital segment (except a median longitudinal band); antennæ black, basal joint fusco-ochraceous, black near the base and with an apical whitish ochraceous ring preceded by a broader black ring, rostrum shining piceous, the articulations testaceous; legs ochraceous, anterior coxæ suffused with fuscous toward the base, anterior femora with two broad fuscous rings, the smaller spines blackish, the larger ones ochraceous with black tip, anterior tibiæ (exeept the basal part and the pilosity of the superior depression) and tarsi black, femora of middle and posterior legs with three black rings, their tibiæ fuscous toward the apex and with a black ring not very far from the base (tarsi of middle and hind legs missing in the type); wings lacteous. First joint of the antennæ not quite reaching the middle of the abdomen, second joint as long as the first, third joint shorter than the head (fourth joint lacking in the type). Hemelytra (♀) not quite reaching the apex of the abdomen. Length, ♀ 17, 6 mm.

French Guiana.—My coll.

The color of the intricately variegated tabby membrane is difficult to describe. Its ground-color seems to be ochraceous and looks as if it were irregularly painted over with fuscous black in various shadings.

N. B. The genus *Phantasmatophanes* Kirk. is identical with *Stenolœmus* Sign. Kirkaldy says that his genus is "distinguished from all the other Ploeariinæ by the very long, thin pronotum and the tufted antennæ and legs." The length of the petiolated part of the pronotum is, however, different in different species of *Stenolœmus*, and Kirkaldy had overlooked that the pilosity of the legs is arranged in tufts also in some other species of *Stenolœmus*, for instance in *St. fasciculatus* Dohrn. *St.* (*Ph.*) *muiri* Kirk. differs from the other species of the genus in having also the first antennal joint tufted, but this, too, is a purely specific character. From the description and particularly from the good figure it is evident that all generic characters of *Stenolœmus* are present in *St. muiri*.—G. W. . Kirkaldy, whose premature death Hemipterology has recently had to deplore, was a most enthusiastic Hemipterist but showed a singular lack of discrimination in estimating generic and specific characters, the result of which was that he greatly augmented the synonymy. In one of his papers he redescribed an old well known genus under three new generic names. The descriptions, taken as they are to a great extent from different organs of the insect, read very different, but the types prove to be congeneric. Ready as he always was

frankly to admit his mistakes, he wrote to me some time before his death that his "Fauna Hawaiiensis, Hemiptera," published in 1902, had to be entirely remade as he under few specific names had lumped together a great many distinct species. He had already published a revision of the Hawaiian species of the genera *Acanthia* and *Reduviolus*, but from his meagre and inadequate descriptions (of the *Acanthiæ*, for instance, and of his numerous new "leaf-hoppers") few of his species can be recognized except those that have been figured. Under these circumstances it is sincerely to be hoped that his collections, including his numerous types and a vast material of undescribed Hawaiian forms, will ultimately be placed in some American or European museum, as they are practically inaccessible in Honolulu.

Luteva rufoannulata sp. nov.

Pale flavo-testaceous, glabrous, prosternum and mesosternum sparingly pilose, head with a basal lateral fuscous spot, prothorax with a lateral fuscous band, mesothorax with a fine lateral white keel margined with fuscous, an apical spot and three basal spots to mesonotum fuscous, scutellum with a median fuscous line not reaching apex, antennæ pale testaceous, first and second joint with an apical white ring, the ring of the first joint being broader, third and fourth joint slightly infuscated, legs pale testaceous, fore coxæ from apex to beyond middle ferruginous, fore femora with three incomplete ferruginous rings, fore tibiæ infuscated at apex, middle femora with the apex white preceded by a ferruginous ring, middle tibiæ narrowly white at base and with a subbasal fuscous ring, their apex with the tarsi fuscous (hind legs wanting, presumably colored as the middle legs), hemelytra whitish hyaline, corium with four subcostal brown spots, the first a little before and the second immediately behind the middle, the third near the anterior basal angle of the membranal discal cell, the fourth at apical angle of corium, veins of the membrane greyish fuscous and margined with the same color, discal cell behind the middle and inner apical cell in the middle with a blackish streak, the vein separating the two outer cells of the membrane with a fuscous spot at its outer end, the anterior outer cell with two fuscous spots, the posterior with one such spot. Head distinctly shorter than pronotum, the postocular part seen from above gradually and rather strongly narrowing backward to near the base where it is suddenly constricted, first and second joint of rostrum of equal length, third joint a little longer than second, first joint of antennæ reaching somewhat beyond the middle of the hemelytra, one third longer than second joint, third joint about three times shorter than second. Pronotum and mesonotum of subequal length. Anterior outer cell of membrane less than two times longer than posterior outer cell. Fore coxæ scarcely shorter than the head and pronotum together, trochanters very finely and sparingly

pilose without conspicuous bristles, fore femora a little longer than the coxæ, fore tibiæ not quite reaching the middle of the femora, half as long again as the tarsi. Length to tip of hemelytra 9 mm.

Jamaica (Mandeville).—Coll. Van Duzee.

This very distinct species cannot be mistaken for any other described form. The abdomen is mutilated; judging from a basal fragment it is pale testaceous with a brownish longitudinal band beneath.

N. B. From Mr. Banks' description of his *Luteva arizonensis* (PSYCHE, 1909, p. 45)—"tibia I nearly as long as femur I, and the tarsus reaching over the trochanter," "scutellum with a long erect spine at base, and a shorter one at apex"—it is clear that this insect has nothing to do with the genus *Luteva* in which the fore tibia is very much shorter than the femur, and the scutellum unarmed.—Under the name *Plœaria carolina* H. Sch. Mr. Banks describes an insect which has almost nothing in common with Herrich-Schæffer's species. There can be no doubt whatever that *Emesodema carolina* H. Sch. is a true *Luteva*, and my friend Van Duzee has sent me a *Luteva* from Florida which is very closely allied to *carolina* but apparently distinct. Judging by the description of the abdomen *Plœaria carolina* Banks (nec H. Sch.) is possibly a larva, either of *Plœaria* or of *Plœariopsis*. Mr. Banks ascribes the character "trochanter I without spines" to *Luteva*, but this is not correct, most species of *Luteva* having one or two strong spinelike bristles on the fore trochanters although they are lacking in other species. "Antennæ hairy" and "antennæ not hairy" are used by Mr. Banks as generic characters, but this should be done with great caution and not without knowledge of both sexes, as in numerous Plœariinae the antennæ are hairy in the males and glabrous in the females.

Ghilianella atriclava sp. nov.

Ferruginous, abdomen testaceous, the clavate apical dilatation of the male abdomen (including the genital segments) and the antennæ and legs black, except the ferruginous middle and hind coxæ and trochanters; head and thorax finely and rather thickly granulated. Apical spine of the head slightly deflected. Basal joint of antennæ reaching the posterior end of the metanotum, second joint a little shorter than first, third joint as long as the postocular part of the head. Mesonotum twice longer than pronotun, metanotum almost half as long again as pronotum. Abdomen as long as thorax, the

spiracles of the first three segments contiguous to the lateral margin. Fore coxæ a little shorter than head and pronotum together; fore femora distinctly longer than mesonotum, their spined part a little longer than the unarmed basal part; tarsi reaching the first spine of the femur, distinctly shorter than tibiæ. Middle femora a little longer than head and thorax together; hind femora almost one third longer than middle femora, reaching over the apex of the abdomen by a little less than half their length. Length, ♂ 24 mm.

Male: Abdomen from its base to near the apex of the third segment very narrow, linear, centrally longitudinally ridged above, apex of third segment, the fourth, fifth, sixth and genital segments jointly clavately incrassate and dilated, the clavate part of the abdomen occupying about one fourth of its total length, subrhomboidal as seen from above, its greatest breadth being near the apex of the fourth segment, longitudinally and transversely strongly convex beneath, the two basal thirds longitudinally convex above, apical third concavely reflexed; fourth segment above immediately within the lateral margins elevated in a subtriangular apically rounded lobe, the two dorsal impressed lines of the segment parallel; dorsal lamina of last abdominal segment triangularly projecting a little beyond the genitals, strongly reflexed, acuminate at apex; connexival part of the last three ventral segments broad, the spiracles remote from lateral margin, apical margin of fourth ventral segment broadly emarginate in the middle, fifth ventral segment almost straight at apex, apical margin of sixth ventral segment rather narrowly sinuate in the middle; first genital segment very short, second long, recurved, linearly impressed beneath from base to beyond the middle; genital claspers moderately broad, not incrassate at apex.

French Guiana.—My coll.

Allied to *Gh. filiventris* Spin., but at once distinguished by the longer metanotum, the black unicolorous legs, etc.

NOTES ON SOME GENERA OF OPHIONINÆ WITH TOOTHED FEMORA.[1]

By Charles T. Brues.

Eiphosoma Cresson.[2]

This genus was first proposed by Cresson (Proc. Ent. Soc. Philadelphia, Vol. 4, p. 52, 1865) for four Cuban species. Since then five others have been described, one from Brazil and the others from Mexico and the southern United States.

The addition of the species here described extends considerably the northern range of the genus which has not been hitherto found north of Missouri.

Omitting the Brazilian species, the others may be separated by the following dichotomy.

Key to the Species of Eiphosoma.

1. Mesothorax with two yellow oval spots anteriorly on its middle lobe; metathorax principally black.....**E. pyralidis** Ashm.
   Mesothorax either yellow with black stripes or black with elongate yellow stripes; metathorax prevailingly yellow or at least with three yellow stripes.....2
2. Metathorax with only a median black line, its anterior suture sometimes black.....3
   Metathorax with lateral black markings additional to the median spot or line.....6
3. Mesopleura with a black spot or oblique line.....4
   Mesopleura entirely yellow; wings entirely hyaline, areolet present.....**E. vitticolle** Cress.
4. Posterior tibiæ entirely honey-yellow; areolet wanting .....**E. nigrovittatum** Cress.
   Posterior tibiæ black, except for a median pale annulus 5
5. Large, length nearly 25 mm. Wings entirely hyaline..... .....**E. mexicanum** Cress.
   Smaller, length 12 mm., wings infuscated somewhat at the tip .....**E. septentrionale** sp. nov.

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[1]Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 34.

[2](Changed to *Xiphosoma* by Szépligeti in the Genera Insectorum, fasc. 54, p. 4, but I believe that the original orthography should be adhered to, and not changed for mere philological reasons.)

6. Wings entirely hyaline.....7
Wings tipped with pale fuliginous.....8
7. Metathorax yellow with the median excavated space and a line (abreviated posteriorly) on each side black.....**E. annulatum** Cress.
Metathorax black with four yellow stripes, the lateral one abbreviated basally .....**E. texanum** Cress.
8. Hind tarsi and hind tibiæ except pale median annulus, black; metathorax with one black line, and a black spot on each side. .....**E. aztecum** Cress.
Hind tarsi and hind tibiæ yellow; metathorax with three black stripes.....**E. atrovittatum** Cress.

Eiphosoma septentrionale sp. nov.

♀ Length 12 mm. Head, thorax and legs yellow, marked with black; abdomen fulvous. Head lemon-yellow; mandibles piceous at tips, and vertex above antennæ, except orbits, black; the black enclosing the ocelli and widening out to cover the entire occiput. Face protuberant beneath the antennæ and again on the clypeus, smooth, with sparse coarse punctures. Mandibles with two equal teeth; palpi four jointed, the basal joint stouter; vertex and occiput medially shagreened, the latter with a few punctures laterally and sharply declivous behind the ocelli; head margined behind on occiput, temples and cheeks, the latter shagreened, a little broader than the malar space. Ocelli in a curved line, separated from each other and from the eye margin by narrow depressions; front below them irregularly aciculated. Antennæ filiform, setaceous toward the tips, about 45-jointed; black, except the two basal joints, first flagellar joint five times as long as thick; following growing shorter, those toward the tip becoming nearly as broad as long. Prothorax entirely yellow. Mesonotum with coarse, separated punctures; yellow, with three broad longitudinal black lines, the median one abbreviated just behind the middle, the lateral ones uniting v-shaped near the base of the scutellum. Scutellum shining yellow, very convex, with a deep transverse furrow at the base that is furnished with a sharp elevated margin laterally. Metathorax incompletely areolated; with two transverse carinæ and one lateral one on each side; spiracles elongate oval; median depression broad, but not deep, lateral ones narrower. Surface of metathorax finely rugulose, entirely yellow except for a median black stripe abbreviated both before and behind, and a thin black line on its anterior suture which meets just above the middle coxa an oblique mesopleural line that extends nearly to the upper anterior angle of the mesopleura. Remainder of pleuræ and underside of thorax yellow and sparsely punctate, the oblique black line depressed and irregularly transversely aciculate.

Abdomen very long and slender, the first segment slightly swollen at the tip, one-half longer than the metathorax; second segment one third longer than the first; third two thirds as long as the second; fourth and fifth subequal, each slightly longer than the third; sixth as long as the second with the ovipositor arising from its tip, the apical segments being very short

and bent downwards. Ovipositor not quite half the length of the abdomen. The abdomen is fulvous except the base of the petiole which is pale testaceous, and a narrow dorsal black line interrupted at the tips of the segments, which is black. Four anterior legs yellow, lighter on the trochanters and base of the middle tibiæ; posterior pair fulvous, their coxæ with a black dot within, their trochanters testaceous; their femora black on the basal third and whitish at tips; their tibiæ black except for broad annulus, and their tarsi black. Wings hyaline except for a faint cloud at the tip. Areolet present[1] petiolate, oblique, median and submedian cells of equal length; discoidal nervure broken far above the middle.

Castle Rock, Pa., collected on August 25, 1907, by Mr. H. S. Harbeck.

Pristomerus Curtis.

Key to the North American Species.

1. Cubital and discoidal veins distinct to the margin of the wing ..... **P. euryptychiæ** Ashm.
   Cubital and discoidal veins obliterated just beyond the second recurrent nervure, from thence to the wing margin continued as scarcely perceptible streaks 2
2. Superomedian area of metathorax broad, scarcely longer than broad, third section of discoidal vein entirely obsolete 3
   Superomedian area nearly twice as long as broad; third section of discoidal vein nearly as long as the transverse cubitus ..... **P. appalachianus** Viereck.
3. Hind coxæ almost entirely black, wings clear hyaline; base of third discoidal cell very strongly contracted at the base (see fig. 8) ..... **P. coloradensis** sp. nov.
   Hind coxæ entirely ferruginous. Wings tinged with yellow; third discoidal cell less strongly contracted at the base. (see fig. 2) ..... **P. pacificus** Cress.

Pristomerus coloradensis sp. nov.

♀ Length 8 mm.; ovipositor 5 mm. Black; head, legs and abdomen in part ferruginous. Head very strongly transverse; face not narrowed below; front much excavated above the antennæ, shagreened and subopaque; face slightly elevated medially and sparsely punctate; clypeus convex, polished, its anterior border broadly rounded; mandibles 3-dentate, yellowish white, with black tips; cheeks punctate, the malar space one third as long as the eye-height; head behind dull, shagreened; distinctly margined. Head clothed with conspicuous white pubescence; the anterior and posterior orbits, widened beneath the antennæ, also the clypeus and cheeks ferruginous. Antennæ slender, first flagellar joint four times as long as thick; second and third slightly shorter, subequal and each three times as long as thick; following

[1] This character is not common to all species of the genus as stated by Ashmead (Classification of Ichneumon Flies, 1900, p. 89).

joints growing shorter, at the apical third becoming nearly quadrate; entirely black. Palpi 5-jointed, black at base and fuscous toward tips. Ocelli well separated, in a triangle, the lateral ones as far from each other as from the eye-margin. Thorax coarsely and closely punctate; mesonotum with quite distinct notauli which converge and fade out posteriorly. Metanotum completely areolated, but with the carinæ very weak and indistinct except on the sides; superomedian area large, pentagonal, as long as the petiolar area, basal area very small, longer than wide. All the pleuræ strongly and coarsely punctate, the punctures more densely placed on the metapleuræ but nowhere confluent. Mesopleura with a smooth space below the root of the posterior wing, bordered below by a row of short striæ.

Thorax black, with only the tegulæ and the extreme margin of the pronotum anteriorly ferruginous. Abdomen scarcely longer than the head and thorax together, strongly compressed beyond the third segment. Petiole suddenly constricted at its middle, the basal portion being less than one half as broad as the apical half; its spiracles placed just before the apical third; its surface shining and very faintly striolate laterally behind the spiracular elevations; seen from the side it is quite strongly curved apically. Second segment as long as the first, shining, very distinctly aciculate along the sides. Gastrocoeli very distinct. Following segments shining. Ovipositor slightly longer than the abdomen. First segment entirely black; second narrowly ferruginous on the apical margin and on the sides behind: third to fifth broadly ferruginous on the sides and behind; sixth and seventh ferruginous with a broad dorsal black line. Legs ferruginous; hind coxæ, except base, hind trochanters, hind tibiæ, except their inner edges, and four posterior tarsi piceous; posterior femora darkened inwardly below and pale yellow at their extreme tips, the femoral tooth moderately long, the denticulations following it very minute. Wings hyaline; third discoidal cell very much contracted inwardly, its base being scarcely one third the length of the second recurrent nervure.

Described from a female collected by Mr. S. A. Rohwer on flowers of *Antennaria microphylla* at Florissant, Col., June 16, 1907, and sent me by Professor Cockerell.

Pristomeridia (?) dubia sp. nov.

Length 9.5 mm. Fulvous, varied with piceous and with the legs more or less pale testaceous. Head fully three times as broad as thick, strongly emarginate on the vertex. Ocelli very large, in an equilateral triangle, distinctly farther from the eye margin than from each other. Inner margins of eyes parallel, the face a little broader than either eye. Vertex subopaque, microscopically roughened; face more shining, with traces of transverse striations and sparse punctures intermixed; clypeus very convex, its margin rounded on the sides and subtruncate medially; mandibles bidentate, leaving a small space between them and the clypeus when closed. Lateral clypeal foveæ distinct, the face with a median convexity between the clypeus and the antennæ. Head behind and cheeks shagreened. Antennæ 35-jointed,

three fourths as long as the body; setaceous; first and second flagellar joints of equal length, much elongated; third and fourth each one third shorter than the preceding one, following joints shortening until those just before the apex are but little longer than wide. Mesonotum shagreened, with sparse and large punctures; notauli very distinct on their anterior half beyond which each one fades out into a group of short longitudinal strigæ. Scutellum convex, subtriangular but sharply rounded at the tip; with a deep crenulated furrow across the base. Metanotum elongated, quite distinctly excavated medially along its entire posterior slope; basal area elongate, 4-sided; median area large, elongate, separated from the elongate petiolar area. Lateral and pleural areas completely separated; spiracles round, of moderate size. Tip of metathorax extending considerably beyond the insertion of the hind coxæ; its upper surface shagreened between the carinæ and sparsely punctate on the sides. Mesopleura with sparse coarse punctures and a deep oblique impression above, its upper anterior angle obliquely striated. Propleura with a few irregular and very indistinct striæ and a few punctures above. Abdomen very long and slender, one half longer than the head and thorax together. Petiole gradually enlarged toward its apex, the spiracles placed at its apical third each one giving off a carina which extends to the basal third of the petiole; second segment as long as the first, shining on its basal third but opaque beyond; following segments much shorter and becoming much compressed. Ovipositor issuing from the apex of the fifth segment, as long as the body. Wings (see fig. 10) pure hyaline, slightly infuscated at their extreme tips; stigma broad, subtriangular, the radial cell moderately long; areolet present, very narrow and strongly oblique; third discoidal cell very much narrowed at its base although the discocubital vein is but little curved; discoidal vein in anterior wing broken far above the middle; in posterior wing complete, unbroken. Legs slender, the posterior femora each with an acute tooth before the apex but without any serrations. Body fulvo-ferruginous; antennæ, except basal joint, and tips of mandibles black; front above antennæ somewhat infuscated, the clypeus, mandibles and inner orbits pale yellow or testaceous. Abdomen with the petiole except base and apex; anterior half of second segment, base of third and dorsal spots on the following segments piceous or black; ovipositor black. Legs pale yellow, the posterior femora except extreme base and apex and the tibiæ at base and apex dull piceous.

Described from a female collected at Blue Hills, near Boston, Mass., August 10, 1910.

This peculiar species apparently belongs to the tribe Pristomerini on account of its broad stigma although the venation is otherwise suggestive of *Eiphosoma* as is also the more strongly produced apex of the metathorax and the indication of a median methathoracic excavation. The genus *Xiphosomella* established by Szépligeti (Gen. Insect. fasc. 34, p. 4; 1905) for a

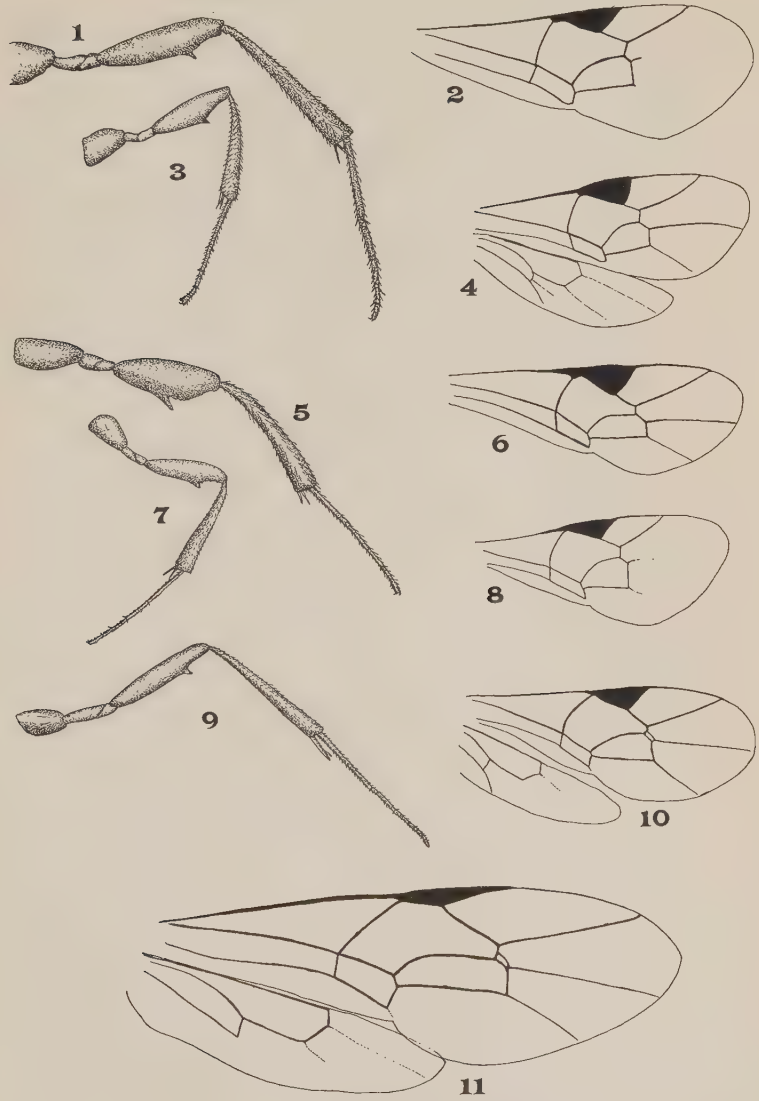
Brazilian species is said (l. c.) to present transitions to certain Pristomerini and Cremastini, and it would appear on the other hand that the present species shows characters also which ally it with *Eiphosoma* and the related *Xiphosomella*.

Mr. H. L. Viereck, of the U. S. National Museum has very kindly compared the drawing of the wing of this species reproduced on the accompanying plate as figure 10 with the specimen of *Porizon agilis* Cress. on which Ashmead based the genus *Pristomeridia* and writes me that "it agrees with the type except in having an areolet and no indication of a break in the nervellus." I believe therefore that it should be placed in this genus. It has been suggested by Szépligeti that *Pristomeridia* cannot be retained as distinct from *Pristomerus*, but the present species is so different in habitus from typical species of the latter, that I do not think the two extremes can be considered as congeneric, whatever disposition be made of the species which seem scarcely separable from *Pristomerus*.

Whether these Ophionine genera with toothed femora form one or even two natural groups must, however, await the discovery of other forms which will no doubt be found.

Explanation of Plate.

Figs. 1, 2. *Pristomerus pacificus* Cresson, leg and wing of female.
Figs. 3, 4. *Pristomerus vulnerator* Panz., leg and wings of female.
Figs. 5, 6. *Pristomerus euryptychiæ* Ashmead, leg and wing of female.
Figs. 7, 8. *Pristomerus coloradensis* sp. nov., leg and wing of female.
Figs. 9, 10. *Pristomeridia (?) dubia* sp. nov., leg and wing of female.
Fig. 11. *Eiphosoma septentrionale* sp. nov., wing of female.



BRUES—OPHIONINAE WITH TOOTHED FEMORA.

NOTES ON THE GUESTS OF SOME CALIFORNIAN ANTS.

By William M. Mann.

Stanford University, Cal.

The following notes are based on a small collection of ants and myrmecophiles made in the vicinity of Stanford University during the spring of 1910. The paper does not include many records, but as there are few exact data recorded concerning the hosts of our western myrmecophiles, I have thought that any additional notes will be worth while.

Unless otherwise noted, all of the ant guests are from nests in the low hills about a mile south of the Stanford University campus. The nests of seventeen species of ants were examined during the spring. Fourteen of these species entertained guests or parasites.

I am under obligations to Dr. W. M. Wheeler of Harvard University who has named most of my ants, and to Prof. H. C. Fall of Pasadena, for examining the type of *Hetærius wheeleri* n. sp. This paper was prepared in the Entomological Laboratory of Stanford University.

Camponotus maccooki Forel. The commonest local Camponotus. On March 5th, I found beneath a stone in a small colony of this ant, a single specimen of *Cremastochilus planatus* Lec. The beetle had evidently been ill treated, both hind and one of the middle tarsi being gone. In a much larger colony, on March 9th, two more specimens were taken. Both of these were perfect. Three weeks later I revisited this nest and took three more of the beetles, one of them with a leg mutilated.

The occurrence of specimens from two nests, one of the nests containing specimens during the greater part of the time that *C. planatus* is taken, tends to show that the occurrence of this species with Camponotus is not altogether accidental. On the same date (March 30) I took two specimens of the same beetle with *Formica rufa* var. *occidentalis* Wheeler. A week later the same nest contained a flourishing colony of Camponotus, which

colony remained up to the time when my observations ceased, so it is probable that the Camponotus occupied the nest, the beetle normally was with them and the occurrence of the Formicas accidental.

Throughout March the cockroach *Ischnoptera* sp. was abundant in most of the nests. It seemed to be tolerated by the ants. All ants are not so indifferent as Camponotus, and in the nests of Formicas, dead and mutilated specimens are common.

The Californian ant-cricket, *Myrmecophila formicarum* Scudder occurs in practically every nest.

Camponotus maculatus sub. sp. **vicinus** Mayr. Common, though less abundant than *C. maccooki*, nesting under stones. The only guest found was *Myrmecophila formicarum*, which was abundant.

Camponotus hyatti Em. Rare. Two colonies found during the year. One of these, found November 4, 1909, had excavated run-ways in a fallen board. This colony was small, only fifteen major and minor workers being taken. On April 19, Mr. E. J. Newcomer took a series from a nest in a rotten log.

Formica rufibarbis var. **occidentalis** Wheeler. Common, nesting mostly under stones. Associated with it are often found small colonies of the little ant *Leptothorax andrei*. The majority of the nests harbor *Myrmecophila formicarum*.

On February 13, I found with this ant a single specimen of a Hetærius, different from any of our described species. Another specimen of the same was taken from a different nest on March 5. They were clinging to the undersides of the stones which covered the nests. I have named this species *Hetærius wheeleri*, after Dr. William M. Wheeler of Harvard University, in recognition of his work on myrmecophily.

Hetærius californicus Horn was found locally only with this ant. The beetle seems to be very rare in collections, but can be found by careful search. Between February 27 and March 30, twenty one specimens were taken. They occur generally singly, or two in a nest, though one nest contained five and another three. Their occurrence in the first was interesting, because the nest had been occupied the previous week by a strong colony of *Tapinoma sessile*, and the beetles had either

moved with the Formicas, or had found and entered the nest later. Tapinoma does not harbor *Hetœrius* as a rule. The very long hairs covering the dorsal surface of *Hetœrius californicus* give the little beetle a distinctive appearance and it is undoubtedly a true symphile. When disturbed, it either feigns death or walks awkwardly away.

Formica cinerea var. **neocinerea** Wheeler. Not common. I have myself found no myrmecophilous insects with this ant, but have before me *Hetœrius tristriatus* Horn, taken at Lake Merced, Cal., March 6, 1910, by Mr. F. X. Williams.

Formica rufa var. near **coloradensis.** Several mounds along Corte Madera Creek were examined, but nothing taken except *Myrmecophila formicarum*, which was abundant. On March 13, in a colony under a board were two specimens of *Batrisus zephyrinus* Casey. They were walking about among the ants, which paid no attention to them.

Formica fusca var. **argentata** Wheeler. Common. Generally in damp locations in the hills. I have taken four specimens of *Hetœrius tristriatus*, one each from four nests of this ant on April 17, 1910.

Prenolepis imparis Say. Common in damp places. This is our local honey ant, but the workers away from the nest are as often seen on carrion or dung as on anything from which they might obtain honey. It harbors *Myrmecophila formicarum*, and often the thief-ant, *Solenopsis molesta* Say.

Tapinoma sessile Say. Abundant everywhere. *Myrmecophila formicarum* occurs in most of the nests, and colonies of *Solenopsis molesta* are common. The nest of one little colony of Tapinoma contained a colony of *Solenopsis* approximately five times as numerous in individuals as the host colony.

On December 22, in a nest containing colonies of both Tapinoma and Solenopsis was a little wingless Proctotrypid, *Isobrachium myrmecophilum* Ashmead. A second specimen was taken from another nest on February 13. Ashmead[1] states that this genus is parasitic upon the ants or upon myrmecophilous Coleoptera. The latter being so rare in the nests of Tapinoma it is probable that Isobrachium is a parasite of the ant itself.

[1]Bull. 45, U. S. Nat. Mus.

Leptothorax andrei Em. Very small colonies are not rare. Those found were either associated with *Formica rufibarbis* var. *occidentalis* Wheeler, or independent.

Stenamma andrei. Common in dry localities. In March and April *Ischnoptera* sp. is abundant in the nests. *Myrmecophila formicarum* is common also. On March 5, I took a single *Cremastochilus pilisicollis* Horn in a large nest, and on the 30th took from two nests, three specimens of *Cremastochilus schaumii* Lec. A specimen of the latter species from the nest of this ant is in the Stanford University collection.

C. schaumii leaves the nests in the early part of April and is seen flying in the sunshine, or more often lying in the roads.

Pheidole californica Mayr. Common, nesting under sticks, stones and old cans. One flourishing nest was under a piece of steel rail. *Solenopsis molesta* frequently shares the nest. The type of the Staphylinid, *Conosoma heathi* Wasmann, was collected in April from the nests of Pheidole, but I took none during my spring collecting.

Solenopsis molesta Say. Common. It nests with *Tapinoma sessile*, *Camponotus maculatus* subsp. *vicinus*, *Camponotus maccooki* and *Prenolepis imparis*. Independent nests are not uncommon.

Cremastogaster lineolata subsp. **coarctata** Say. Common under stones in damp places. *Myrmecophila formicarum* occurs in most of the nests.

Hetaerius wheeleri sp. nov.

Length 2 mm. Color reddish brown. Form broadly oval, robust, shining. Upper surface finely punctate, each puncture with fine recumbent hair. Head piceous, coarsely punctate, hairy; front concave. Prothorax wider than long, narrowed in front; margin inflexed at the third distance from base, separated from disc by impunctate impression, which becomes broader and deeper from front to rear and ends in deep pit at the posterior angle; divided at basal third by shallow impression; the posterior part elevated, piceous, the anterior part flat; disc wider than long, punctate, each puncture with fine hair. Elytra slightly wider than thorax at base; outer striæ becoming confluent with margin at about one half distance to base of elytra; the first two discal striæ nearly attaining the apex of the elytra; inner striæ extending about two thirds the distance to apex. Propygidium finely punctate, hairy. Prosternum flattened, coarsely punctured, emarginate at base and apex, margined at summit from base to five-eights distance from base to apex;

marginal lines sinnate between and diverging in front and rear of coxæ. Front femora about one third as wide as long.

Type and the single paratype taken from a nest of *Formica rufibarbis* var. *occidentalis* Wheeler, at Stanford University, California.

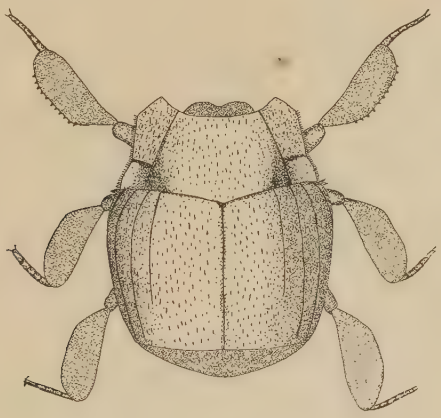


Fig. 1. *Hetærius wheeleri*, sp. nov.

The size, structure of prothorax and the scattered, recumbent hairs will separate this species from those near it.

There are eleven denticles on the outer edge of the anterior tibiæ. The number seems to vary among the different species, but to be fairly constant in the same one and may be of some taxonomic importance.

WESTERN LEPIDOPTERA IV.

By Carl R. Coolidge.

Pasadena, Cal.

Polites coras Cramer. Mr. F. Grinnell, Jr., has lately given me several specimens of this species, better known as *P. peckius* Kirby (*peckii*!), taken by Mr. C. W. Herr at Priest River, in northwest Idaho. *Coras* is a common eastern species, but I do not believe that it has hitherto been recorded from further west than Kansas.

Lycaena marina Reakirt. Egg. In shape round, abruptly flattened both apically and basally; the micropylar area much concave; a fine whitish lace work, with the meshes subrectangular, and the angles somewhat elevated, covers the surface; color when first laid a delicate light bluish green, soon changing to a pure cream color; diameter about .02 inch. The duration of this stage varies considerably, due to the prevailing weather conditions. Some eggs hatched in slightly less than three days, while others required as many as nine days. The larva accomplishes its emergence by eating away a considerable area about the micropyle. The rest of the egg is left intact. *Marina* is one of the commonest butterflies of the Far West, yet next to nothing is known of its habits. In the Huachuca Mountains of southern Arizona I found the larva feeding on five different food-plants, and I do not doubt but that there were more in that one locality. At present I can recognize specifically one of these, which is *Lathyrus larvatus*.

Atalepedes mesogramma Latreille. Dr. Dyar in his Review of the Hesperiidæ of the United States (Jour. New York Ent. Soc., vol. 13, p. 127, 1905) includes this species in our fauna "on the authority of Mabille, who credits the species to 'North America'. This may refer to the West Indies or Mexico." *Mesogramma* must, however, be stricken from our lists since it appears to be confined strictly to Cuba and the Bahamas. Scudder, in his Systematic Revision of some of the American

Butterflies (4th Ann. Rept. Trustees Peabody Acad. Sci., p. 78, 1872) erects the genus Atalopedes without description and includes two species, *Hesperia huron* Edwards and *H. campestris* Beisduval, the former being named as the type. These two species are now known to be identical, *campestris* having priority. *Pamphila kedema* Butler, from an unknown locality, also falls into synonomy here. Further, on page 81, Dr. Scudder founds the genus *Pansydia*, making *Hesperia mesogramma* the type, which he apparently places in synonomy with *H. cunaxa* Hewitson. These two species are also one and the same, *mesogramma* retaining. Dr. Scudder gives Poey as the author of this, but presumably in error, as I find Latreille is given by all the other writers to whom I have referred. *Pansydia* is acknowledged to be a synonym of *Atalopedes*, which can then be seen to contain two species, *A. campestris* Boisduval and *A. mesogramma* Latreille, the latter occurring with us. However, I do not at all believe that *Atalopedes* is worthy of generic rank, but for the present I shall leave it so, although I hope to show that such secondary sexual characters as the discal stigma or the costal fold do not alone indicate generic difference.

Melitaea cerrita Wright. Butt. West Coast, p. 161, No. 189, pl. 20, fig. 189, ♂, a, ♂, underside, b ♀, 1905. Described from 1 ♂, 1 ♀, the type locality being given as "Southern California." Mr. Wright, however, pointed out the exact habitat to me last spring, which is Little Mountain, several miles to the north of San Bernardino, and not far from the original locality of *M. wrighti* Edwards. *Cerrita* is a pure aberration of *wrighti*, with which it will be placed in synonomy. I have elsewhere remarked that I cannot consider *wrighti* and *leanira* specifically distinct, but would consider them as *M. leanira leanira* Boisduval and *M. leanira wrighti* Edw. In this connection it is interesting to note that W. H. Edwards, after his original description of *wrighti*, adds, "from 1 ♂, and 1 ♀ sent me by Mr. W. G. Wright at San Bernardino flying with *leanira*." The length and form of the antenna and the antennal club have for some time been used as taxonomic characters, but the coloration and annulation of these have perhaps been unduly neglected.

For instance, *leanira leanira*, *leanira wrighti* and *alma* Strecker, of which I shall elsewhere show *fulvia* Edwards and *cyneas*

Godman and Salvin are synonyms, may be differentiated as follows:

1. With no black markings at base of secondaries below.....2
   With these markings.....3
2. Antennæ wholly ferruginous.....**leanira leanira**
   Antennæ black, the tip only partially ferruginous....**leanira wrighti**
4. Antennæ distinctly annulated black and white.....**alma**

In *wrighti* I think I can see a faint whitish annulation, and this may vary. In both *alma* and *wrighti* the white is sometimes continued along the sides of the club. While I have not examined extensive series in this respect, the above characters hold in the specimens at hand.

ADDITIONS TO LIST OF SPHINGIDÆ OF AMERICA NORTH OF MEXICO.

Since the publication of our list of Sphingidae[1], we have become aware of two species which should have been included therein. We therefore add:

(2 1-2) **Cocytius cluentius** Cram.

Dr. W. W. Newcomb of Detroit has kindly called our attention to the fact that he took a specimen of this species near Detroit and that a further specimen is recorded from Chicago. (vide Ent. News, vol. 15, p. 345.)

(86 1-2) **Proserpinus vega** Dyar. N. M.

We must apologize to Dr. Dyar for having overlooked this species; the omission of *P. terlooii* (Dyar, No. 662) is intentional as we know of no authentic record of this Mexican species from Georgia.

Wm. Barnes and J. J. McDunnough.

[1]Psyche, Vol. 17, pp. 190-206. (October 1910.)

SOME CARABIDÆ TAKEN IN CONNECTICUT.

By Alfred B. Champlain.

Agricultural Experiment Station, New Haven, Conn.

Among the Carabidæ taken in Connecticut during the past year, 1910, a few, mostly from the vicinity of New Haven and Lyme, seem worth recording.

A series of arc lights near the Experiment Station yielded a number of interesting species to which the "at arc" records refer.

Omophron tessellatum Say. New Haven, 22 June, one specimen at arcs.

Cychrus lecontei Dej. appeared to be quite plentiful; at Lyme, Oct. 9, I captured three pairs and a number of single specimens.

Cychrus elevatus Fabr. Lyme, 25 Sept., 9 Oct.; this species has been taken in almost every section of the state, and the preceding species is undoubtedly as well distributed.

Cychrus viduus Dej. is represented in the Station collection by one specimen taken July 7, 1905, at Torrington, Ct., by Dr. W. E. Britton.

Calosoma externum Say, New Haven, 19 May, 1903, one specimen, collected by B. H. Walden.

Calosoma scrutator Fabr., Conspicuous by its absence. But one specimen taken at arc lights.

C. willcoxi Lec. Plentiful at arc lights and under stones in May and June. Observed upon trees feeding upon canker worms.

C. frigidum Fabr. New Haven, May and June. Also collected by the men employed in turning bands in gypsy moth work at Wallingford.

C. callidum Fabr. Several at arc lights. One specimen observed feeding upon *Serica sp.* directly under arc.

Carabus nemoralis Mull., Hartford, Ct., 1 Sept., 1909, R. W. Curtis; New Haven, Ct., 2 April, 1906, Miss E. B. Whittlesey; Oct. 3, Nov. 3, 1910, D. J. Caffrey.

Carabus sylvosus Say. Lyme, May, July, October; this is the narrow form.

Trechus chalybeus Mann. New Haven, 19 Nov.; two specimens taken in swamp, under fallen leaves.

Myas cyanescens Dej. Lyme. A few specimens were taken in July and Sept. from under fallen branches and logs, and one specimen was dug from the stem of a toadstool. Mr. C. A. Frost of South Framingham, Mass., writes me that he has taken this species under fungi while digging for *Geotrupes*. The specimens all measured about 17 mm. in length, and in size nearly approach my Pennsylvania specimens of *M. coracinus* Say.

Pterostichus adoxus Say, very common in and under dead logs. P.

lachrymosus Newn., Lyme, 26 July, one specimen. **P. appalachius** Horn, New Haven, 7 May; **P. coracinus** Newn. was fairly common at Lyme; **P. stygicus** Say, **sayi** Brullé, **lucublandus** Say, **luctuosus** Dej., **corvinus** Dej., **mutus** Say, were common everywhere. **P. scrutator** Lec., New Haven, 13 June, one specimen at arcs measures 18 mm.; Lyme, 4 Dec., one specimen under moss near swamp measures 13.5 mm.; both females. **P. erythropus** Dej., not plentiful; two specimens from Lyme, 11 April, with the legs black. **P. patruelis** Dej. New Haven, 19 Nov., common in swamp.

Amara latior Kirby, New Haven, 28 June, one specimen at arcs. **A. apricaria** Payk., plentiful at arcs.

Diplochila laticollis Lec. New Haven, 9 July, one specimen at arcs.

Dicaelus purpuratus Bon. A number of specimens, Lyme, New Haven Meriden. **D. elongatus** Bon., common everywhere. **D. politus** Dej., Lyme, 9 Oct.

Badister pulchellus Lec., one specimen, and **B. micans** Lec., two specimens, Lyme, 3 July, at a window where I had placed a lamp.

Calathus impunctatus Say, quite common in the spring under stones.

Lebia pectita Horn, Lyme, August 24, common on flowers of yarrow, each flower containing three or four specimens.

L. pulchella Dej., Lyme, June and July, under stones.

L. scapularis Dej., New Haven, 4 June, one specimen.

Cymindis americana Dej., **pilosa** Say, **neglecta** Hald., New Haven.

Helluomorpha bicolor Harr., Lyme, 29 May; New Haven, 16 May, and Seymour, Ct.

Chlaenius laticollis Say, Lyme, 1 May.

Geopinus incrassatus Lec. New Haven, 14 June, one specimen, at arcs.

Harpalus was represented at the arc lights by most of the common species. One specimen of **H. lewisii** Lec., and several of **H. laticeps** Lec. were taken at New Haven, 28 June, at arcs.

NEW PREDACEOUS AND PARASITIC ACARINA.

By H. E. Ewing.

Ithaca, N. Y.

The new species of mites here described will nearly all be treated of more fully later. In this paper are included the descriptions of two species which have a prime economic importance, as they are two of the few species of mites which are largely responsible for holding in check the oyster shell and other scales. These forms, one a species of *Tydeus*, the other a *Tarsonemus*, were studied by the writer while working at the Iowa Experiment Station last summer, and will be treated of fully later by Mr. R. L. Webster in a special bulletin upon the oyster shell scale.

Another of the mites described is very interesting on account of both its scientific and economic importance. It is a new species of the genus *Stigmœodes*, and the first of this genus to be found in North America. The members of this genus are long drawn out, and have the body strongly constricted at the middle which causes them to resemble strongly a pair of twins which have been born attached to each other. This species was sent in by Mr. S. A. Johnson from the Colorado Experiment Station, where it is very abundant. It belongs to the group called the "Red Spiders" which are so notorious for their attacks upon greenhouse plants and shade trees, and is a species which deserves careful watching as it is liable to take up habits similar to the others of its group and cause serious damage to cultivated plants.

Two species of *Analgesidæ*, "Bird Mites," are described. One of these, an *Alloptes* was sent to me this last summer from the Bermuda Islands by Mr. A. O. Gross, who obtained the specimens in great quantities from a tropical bird.

Complete illustrations of most of these species will be published soon in a paper by the author on the "Phylogeny and Distribution of the Parasitic Acarina."

Gen. **Tydeus** Koch. (Eupodidæ.)

Tydeus coccophagus sp. nov.

Without color, being hyaline in appearance. Body and legs only sparsely clothed with moderate bristles.

Cephalothorax subconical. Eyes lateral and over twice their width from the posterior margin of cephalothorax. Mouth-parts in the form of a beak, and extending forward for about one-half the length of the first pair of legs.

Abdomen two-thirds as broad as long, and with the posterior end evenly rounded. A pair of small shoulder bristles present, and three pairs of bristles are situated on the posterior margin of the abdomen, the outer pair being slightly the longest.

First pair of legs slightly longer than the others. Second pair reaching to about the middle of the first pair. Hind pair of legs barely reaching the tip of the abdomen; tarsus one and a half times as long as the tibia, tibia one and a half times as long as the patella which is as broad as long.

Length, 0.20 mm.; breadth, 0.11 mm.

This species was found in abundance attacking the oyster shell scale during the month of August, at Ames, Ia. The individuals flee with great rapidity from under the scale when it is lifted with a knife-blade.

Gen. **Harpyrhynchus** Mégnin. (Cheyletidæ.)

Harpyrhynchus brevis sp. nov. (Pl. 7, fig. 4).

General appearance hyaline. Integument finely striated by concentric lines for a large zone next to the margins of the body. This striated area extends inward for about one-half the distance from the margin to the center of the body.

Beak large, stout, extending forward to about the tip of the first pair of legs. Dorsal hooks four in number, stout and strongly recurved. Each palpus bears a very long bristle about equal to the total length of the beak.

Body circular in outline with sinuate margins. On the dorsal surface near the base of the beak there is a large pair of posteriorly directed bristles which extend almost to the posterior margin of the body; a similar but slightly longer pair of lateral bristles is present just behind the second pair of legs.

Anterior group of legs stout, subequal, and terminated each with two claws; tibia and tarsus subequal in length, the former somewhat broader than the latter. Posterior group of legs very short and each terminated with from five to seven enormous bristles which are longer than the body of the mite. The last pair of legs extends to the margin of the abdomen.

Length, 0.28 mm.; breadth, 0.24 mm.

From *Coccothraustes vespertina* ♂. Described from three specimens.

Gen. **Syringophilus** Heller. (Cheyletidæ.)

Syringophilus elongatus sp. nov.

Hyaline: body enormously drawn out, about five times as long as broad. Integument striated except for the middle region of the cephalothorax.

Cephalothorax, including beak, almost as long as abdomen; beak conical; palpi short and extending to tip of beak where the small lance-like mandibles may be seen projecting forward. On the dorsal surface of the beak is a prominent pair of bristles about two-thirds as long as the beak itself. Dorsal surface of cephalothorax proper with at least six pairs of enormous, long bristles which extend about two-thirds the distance to the tip of abdomen.

Abdomen very long, cylindrical, and with about four pairs of large, dorsal bristles and two pairs of smaller terminal bristles. Posterior end of abdomen emarginate.

Legs subequal; first pair extending to tip of beak, posterior pair reaching about one-half the distance from the point of their origin to the tip of the abdomen. Segments of the legs subequal in width, the distal segment in each case with a large, bifid appendage, the parts of which are themselves each resolved into several elements. Tarsal claws of front group of legs stout, and strongly curved.

Length, 1.00 mm.; breadth, 0.18 mm.

From red winged blackbird, *Agelaius phœniceus*. Described from about half a dozen specimens.

Gen. **Stigmaeodes** Canestrini. (Tetranychidæ.)

Stigmaeodes cinctus sp. nov. (Pl. 7, fig. 2).

Body and appendages of a light cardinal color; in the region of the eyes color much darker. Body with pronounced constriction at its middle, giving it the appearance of being girded and compressed with a belt, hence the name *cinctus*.

Cephalothorax as long and as broad as the abdomen. Mouth-parts rather small; beak extending about half way to the tips of the front legs. Palpi very small and just reaching the tip of the beak; distal segment bearing a spine-like bristle longer than the segment itself. A double pair of lateral eyes present at about half the distance from the anterior to the posterior end of the cephalothorax.

Abdomen conical in shape and tipped at the end with three pairs of simple, curved bristles, the inner pair being about two-thirds as long as the others. Abdomen broadest slightly in front of the third pair of legs. It bears dorsally only a few inconspicuous hairs.

Front group of legs situated far distant from the hind group; all the legs subequal; posterior pair extending about one-third their length beyond the hind margin of the abdomen. Each tarsus bears at its tip two small, curved claws and a much larger bifid, pectinated adhering organ.

Length, 0.40 mm.; breadth, 0.12 mm.

In wild grass. Collected at Fort Collins, Colorado by S. A. Johnson, from whom I received an abundance of live material. This is the first species of this rare genus which has been recorded from America. These mites are of very slow movement, and their long drawn out body causes their gait to appear ludicrous.

Gen. **Tarsonemus** Canestrini and Fanzago. (Tarsonemidæ.)

Tarsonemus chionaspivorus sp. nov.

Male. General appearance almost hyaline. Mouth-parts and posterior pair of legs more chitinized than the other parts.

Beak, or cephalic papilla, rather prominent; extending for three-fourths the length of the first pair of legs.

Cephalothorax as broad as long. Epimera of the first pair of legs united to a median piece so as to form a Y; those of the second pair of legs similarly united. The base of the Y formed by the epimera of the first pair of legs is joined to the fork of the Y formed by the epimera of the second pair of legs so that the two stem pieces of these Y's make a median longitudinal sternum.

Abdomen longer and broader than the cephalothorax. Genital papilla about as long, but broader than the cephalic papilla with its sides almost straight and parallel.

Anterior group of legs subequal and sparsely clothed with moderate, simple bristles; the second pair extending forward for one-half the length of the anterior pair. Third pair of legs similar but slightly longer than the second pair. Fourth pair of legs very stout, twice as thick as the third pair, strongly curved and ending in a stout, sharp claw about equal in length to the segment next to it. Near the base of this claw is situated a very long bristle slightly longer than the fourth leg itself.

Length, 0.15 mm.; breadth, 0.09 mm.

Female. Legs almost hyaline; body and beak, which have the integument more chitinized, brownish yellow.

Cephalic papilla two-thirds as broad as long; broadest at the base. Epimera of the first pair of legs united at the median line so as to form a Y; epimera of the second pair of legs not united. Cephalothorax broadest at its base where it joins the abdomen.

Sides of abdomen straight and approaching each other as you pass from the anterior to the posterior end. A pair of shoulder bristles present, about as long as the femur of leg III. Posterior margin of abdomen with but two minute bristles.

Legs of the anterior group subequal; those of the second pair extending forward for two-thirds of the length of the first legs. Tibia of third pair of legs about twice as long as tarsus. Last segment of leg IV about one-third as long as penultimate segment, and bearing at its free end two large bristles, the shortest of which is about twice as long as the segment itself; the longer bristle is fully twice as long as the shorter.

Length, 0.16 mm.; breadth, 0.08 mm.

From *Chionaspis* sp. on poplar. Specimens collected by the writer at Ames, Ia., while engaged in studying the oyster shell scale.

Gen. **Histiostoma** Kramer. (Tyroglyphidæ.)

Histiostoma phytophaga sp. nov.

Body granulate, greyish; legs flesh color. Cephalothorax as broad as long. Mandibles sharp, tapering; teeth sharp and uniform. Palpi moderate; anterior, lateral, hyaline projection tapering like a broad bristle, almost as long as tarsus of leg I; posterior, lateral projection strongly recurved and not more than half as long as the anterior.

Abdomen two-thirds as broad as long, evenly rounded behind and with a few, small, curved, simple bristles.

Anterior legs extending beyond the tips of the palpi by about one-third their length; tarsus very much narrowed near its base and ending in a stout claw, and a long seta which is equal to the segment itself in length. Near the tip of tarsus I on its outer margin is a stout spine almost as long as the tarsal claw; a very small bristle is on the lateral margin near its middle; on the inner margin near the tip are two small spines, and also a small one near the middle of the inner margin. Tibia of leg I as broad as long, and about one-third as long as the tarsus. Posterior pair of legs slightly larger than the third pair and reaching the tip of the abdomen.

Length, 0.31 mm.; breadth, 0.20 mm.

I found this species upon a very small plant in a little cell containing earth where I was rearing one of the common "Red Spiders." Described from two specimens.

Gen. **Alloptes** Canestrini. (Analgesidæ.)

Alloptes longipes sp. nov. (Pl. 7, fig. 3).

Integument well chitinized; posterior group of legs in the case of the adult males more strongly chitinized than the body.

Adult Male. Beak small, inconspicuous, reaching to about the middle of the third segment of leg I.

Body broadest in front of the third pair of legs then becoming rapidly narrowed until the tip is reached. Epimera of first pair of legs fused together at the median line; those of the second and third legs united into a Y on each side of the body. The bases of the two Y's thus formed are united to a medial strip which joins them to the epimera of the fourth pair of legs. From the posterior margin of the abdomen extends a long pair of bristles equal to the entire length of the body of the mite. Each of these bristles has an enormous swollen region near its middle.

Legs of the anterior group subequal; the anterior pair a little over twice as long as the beak. Legs of the posterior group very large, fourth pair exceeding the third considerably and reaching beyond the tip of the abdomen by about

one-half its length. Distal segments of last pair of legs large, stout, and hook-like; each bears two small, dull, tooth-like tubercles on its inner margin near the base; penultimate segment about as long as the last segment.

Females of the Copulating Stage. Several males were found in copulation with the young females. These females were much smaller than the males and of a hyaline appearance. Mature females were not found.

Length of male, 0.60 mm.; breadth, 0.41 mm.

From a tropical bird. Many specimens were sent to me by A. O. Gross from a sea bird killed in the Bermuda Islands.

Gen. **Analges** Nitzsch. (Analgesidæ.)

Analges passerinus Linn.?[1] (Pl. 7, fig. 1).

Male. Integument moderately and uniformly chitinized. Body and legs clothed with many very large, long bristles.

Cephalothorax much broader than long; beak rather small, palpi reaching its tip. From the posterior margin of the cephalothorax there extends backward two pairs of long bristles which reach as far as the tip of the abdomen.

Abdomen broadest at the insertion of the third pair of legs, rounded on the postero-lateral margin while it is terminated in two small projection near the median line. On its dorsal surface near the insertion of the third legs there are two very long bristles; on the lateral margins in front of the third legs are situated three pairs of very large bristles, the posterior of which are only about one-half as long as the other two pairs; at the tip of the abdomen are three pairs of bristles, the outer pair of which is less than half as long as the other two pairs.

Legs of the anterior group subequal. Legs of the third pair enormously enlarged, being almost equal to one-half the width of the body, and extending one-half their length beyond the tip of the abdomen; last segment formed into a great claw which has a tooth-like, bristle-bearing tubercle on its inner margin near the middle. This segment bears in all, four large bristles. Legs of the fourth pair reaching beyond the posterior margin of the abdomen by the length of their last segments.

Length, 0.45 mm.; breadth, 0.27 mm.

Female. Integument less chitinized than in the male; body subrectangular.

Cephalothorax much broader than long; beak of moderate size, palpi extending slightly beyond its tip. From near the posterior dorsal margin of the cephalothorax there extends a long pair of bristles which reaches to the posterior margin of the body.

Abdomen with sides about parallel; postero-lateral margin oval. On the shoulder is situated a pair of long bristles which extend beyond the posterior end of the body; two other pairs of bristles are found on the dorsal surface

[1] This species does not agree with the one which figures in Banks' "Treatise on the Acarina," Proc. U. S. Nat. Mus., vol. 28, p. 91, under the name of *A. passerinus*, but agrees perfectly with a named specimen of *A. passerinus* sent from Europe by Dr. Trouessart.

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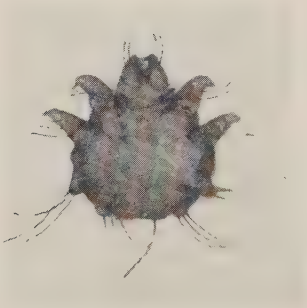


4

EWING—PREDACEOUS AND PARASITIC ACARINA.

of the abdomen each about half as long as the shoulder bristles; two long pairs of bristles are found situated at the tip of the abdomen.

Legs of the anterior group subequal, apophyses well developed. Legs of the posterior group longer than those of the anterior group; those of the fourth pair extending beyond the posterior margin of the abdomen by one-third their length.

On red winged blackbird, *Ageliaus phœniceus*. Described from several specimens taken from blackbird skins in the Iowa State College Museum.

Explanation of Plate 7.

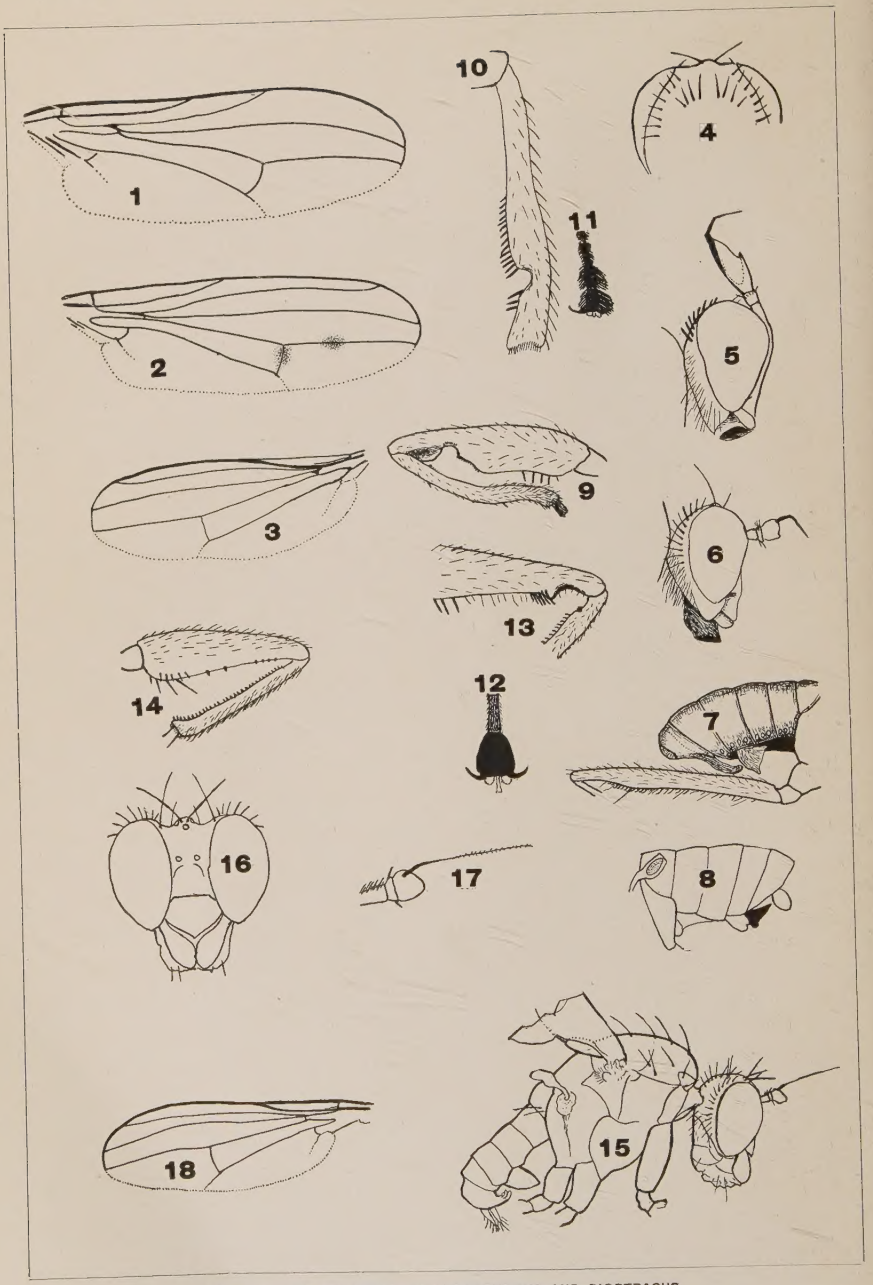
From photomicrographs by the writer.

Fig. 1—*Analges passerinus* Linn.? dorsal view of male, × 75.

Fig. 2—*Stigmaeodes cinctus* sp. nov. dorsal view showing marked constriction of the body, × 75.

Fig. 3—*Alloptes longipes* sp. nov. dorsal view of male, × 45.

Fig. 4—*Harpyrhynchus brevis* sp. nov. dorsal view, × 75.



ALDRICH.—NORTH AMERICAN HYDROPHORUS AND DIOSTRACUS.